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JOURNAL

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ABSTRACTS OF CHEMICAL PAPERS PUBLISHED IN BRITISH AND FOREIGN JOURNALS.

PART II.

General and Physical Chemistry.

Spectrum of Helium. By WILLIAM CROOKES (*Chem. News*, 1895, **72**, 87—89).—Helium from different sources was examined spectroscopically. Five samples of gas came under investigation: (1) from clèveite, (2) from the uraninite of Hillebrand, (3) from Bröggerite, (4) from Bröggerite by fractional distillation, (5) "Helium Purissimum," gas obtained by Ramsay from various sources and purified to the highest possible point. The gas was sealed in tubes and exhausted to the most luminous point for spectroscopic examination. In most cases, no internal electrodes were employed, but metallic terminals were attached to the outside of the tube. The wave-lengths observed are given on Rowland's scale, and lines in the spectra of mercury, cadmium, zinc, and tin were used for reference. Tables are given of the wave-lengths of lines which appear to be special to the gas from uraninite, to all samples of the gas, and lines probably identical with those of the chromosphere and prominences. H. C.

The Constituents of the Gas from Clèveite. By CARL RUNGE and F. PASCHEN (*Phil. Mag.*, 1895, [2], **40**, 297—302).—The authors have carefully mapped and recorded all the lines found in the spectrum of the gas from Clèveite, the bolometer being employed for the infra-red rays. Six series of lines are obtained, which the authors consider are divisible into two systems. Of these series, it is noticeable that two consist of double lines with equal differences of oscillation frequency. The spectrum also shows considerable analogy to those of the alkalis, as is seen by the comparison of the diagrams of hydrogen, clèveite gas, and lithium spectra. It further appears from this comparison that the helium series (the series containing the D_3 line) corresponds with the constituent of higher atomic weight, a result confirmed by the observation that when the gas is allowed to stream into an exhausted Geissler tube through an asbestos plug, the helium series does not reach its maximum of brightness as quickly as the other series. The authors assign the atomic weight of 5 and 3 as probable for the two constituents. L. M. J.

Argon and its Fluorescence Spectrum. By E. DORN and HUGO ERDMANN (*Annalen*, 1895, **287**, 230—232; compare Abstr., 1895, ii, 337).—The authors criticise Berthelot's examination of the fluorescence spectrum of argon, obtained on submitting a mixture of benzene vapour with the gas to the action of the silent discharge (*loc. cit.*). They maintain that the brilliant yellow line at about λ 579, and the green line at about λ 547, have the appearance of double lines; they point out that these lines coincide with prominent bands of the mercury spectrum, and attribute the brilliant violet band at about λ 438 to the same source, the violet band at about λ 436 being probably due to nitrogen. M. O. F.

Blue Spectrum of Argon. By HEINRICH KAYSER (*Chem. News*, 1895, **72**, 99—100).—A preliminary list of the wave-lengths of the lines of the blue argon spectrum between $\lambda = 340\ \mu\mu$ and $\lambda = 520\ \mu\mu$ is given. The lines of the blue argon spectrum do not appear among the Frauenhofer lines, as appears from a comparison with Rowland's publications on the lines of the solar spectrum. H. C.

Spectrum of Ramsay's Compound of Argon and Carbon. By WILLIAM CROOKES (*Chem. News*, 1895, **72**, 99).—The compound of argon and carbon formed by an electric arc between purified carbon poles in an atmosphere of argon (this vol., ii, 20) has been submitted to spectroscopical examination. No lines other than those of the argon, carbon, or water vapour spectra were observed, the spectrum of water vapour being due to the gas not having been perfectly dried before it was sealed in the tube. The compound of argon and carbon gives a channelled band-spectrum similar to that of most carbon compounds. H. C.

Different Spectra of Mercury. By JOSEPH M. EDER and A. VALENTA (*Ann. Phys. Chem.*, 1895, [2], **55**, 479—502).—The authors have examined the behaviour of the mercury spectrum at different temperatures and under different conditions of pressure, studying the spark and arc spectrum and the spectrum of mercury in vacuum tubes. They have in this way extended the data for the line spectrum and have discovered a new band spectrum of mercury, to which special interest attaches as mercury vapour is thus shown to be analogous to other gases, such as hydrogen and nitrogen, for which also line and band spectra have been observed. This band spectrum appears only under certain definite conditions, namely, when the spark of a powerful induction coil (without Leyden jar) is passed through a vacuum tube in which a drop of mercury is kept at the boiling point and is therefore being distilled. A description and measurements of the principal lines in the two mercury spectra are given in the paper. The occurrence of the two spectra in the case of mercury is of peculiar interest, as in other instances the band spectra have been attributed to molecules composed of several atoms and the line spectra to the atoms themselves. This explanation will obviously not hold in the case of mercury, the molecule of which is known to be monatomic. H. C.

Transferring Gases to Vacuum Tubes for Spectroscopic Examination. By James Young and Charles R. Darling (*Chem. News*, 1895, **72**, 39).—The vacuum tube is fused to one arm of a T-piece of capillary glass tubing fitted with a three-way cock at the junction, another arm connects with a vacuum pump, and the third arm, by means of a mercury joint, with the gas in a tube over mercury; the gas tube has an ordinary stopcock at the top. The operations to be followed are exhausting the vacuum tube, exhausting the tube space between the stopcocks, washing the vacuum tube by admitting some of the gas three times successively, exhausting between each, and then finally charging the tube, which may be examined while attached to the system or may be sealed off and examined subsequently.

D. A. L.

Action of the Infra-red Rays on Silver Sulphide. By H. Rigollot (*Compt. rend.*, 1895, **121**, 164—166).—Two plates of silver, sulphurised by electrolysing a solution of sodium sulphide with a weak current for a short time, and placed in a dilute saline solution, constitute an electrochemical actinometer. With plates, 40 mm. long and 2 mm. broad, the effect of the infra-red rays of the solar spectrum can be traced to a considerable distance below the visible red, and the minima at 96 and 116, and the maximum at about 104, observed by Langley, can be recognised. The maximum electromotive force developed is 0·003 to 0·004 of a volt. In the visible spectrum, the effect decreases rapidly from A to F, and then becomes negligeable.

By arranging the two plates in a U-tube, one limb of which can be heated, it is found that a difference of 6° to 7° is necessary to produce an E.M.F. of 0·002 volt. Moreover, the illuminated plate is always negative to the other, whatever the nature of the saline solution, whilst the heated plate is negative to the cold plate in solutions of silver salts, but positive in solutions of all other salts. It follows, that the effect of the infra-red rays cannot be attributed solely to an increase in the temperature of the illuminated plate. C. H. B.

The Clark Cell when Producing a Current. By Sidney Skinner (*Phil. Mag.*, 1895, [5], **39**, 375—376).—A reply to some criticisms of Threlfall on the author's previous paper (Abstr., 1895, ii, 34). L. M. J.

The Tin Chromic Chloride Cell. By Sidney Skinner (*Phil. Mag.*, 1895, [5], **39**, 444—447).—A cell is formed, in which one electrode is a tin amalgam at the bottom of a test tube, the other a platinum plate, and the electrolyte is a solution of green chromic chloride. The action of this compound on tin is a reversible one,

$Cr_2Cl_6 + Sn \rightleftarrows SnCl_2 + 2CrCl_2$, the direct action occurring at high temperature. The author shows that the E.M.F. is not zero at ordinary temperatures, as stated by Case, but is about 0·44 to 0·52 volt, and alters only very slightly when heated to 100°. The cell polarises, however, so rapidly at low temperatures, that at the moment of connection the effective E.M.F. is almost zero, which is the probable cause of Case's results. L. M. J.

New Form of Battery. By MORISOT (*Compt. rend.*, 1895, **121**, 251—253).—The outer cell contains a plate of gas carbon immersed in a mixture of 1 volume of sulphuric acid with 3 volumes of a cold saturated solution of potassium dichromate; the inner cell contains an amalgamated zinc plate in a concentrated, aqueous solution of sodium hydroxide, and there is an intermediate porous cell containing a solution of sodium hydroxide of sp. gr. about 1·05. The object of this intermediate cell is to retard the formation of normal chromate in the outer cell, and of zinc hydroxide round the zinc plate.

The E.M.F. of the cell is 2·5 volts at first, provided the porous cells have become thoroughly impregnated with liquid before the circuit is closed, and remains higher than 2·4 volts even after 10 hours uninterrupted action.

The substitution of a concentrated solution of sodium hydroxide for the dilute acid in a Bunsen cell, has the same effect on the E.M.F., and increases it by 0·4 volt. The zinc is less readily attacked by the alkali solution than by the ordinary dilute acid, but the expenditure of zinc is partly replaced by expenditure of alkali, and if carbon is substituted for zinc in the inner cell, there is at first an E.M.F. of 1 volt. If the zinc were attacked to the same extent as in the Poggendorff cell, there should be an E.M.F. of 3·1 volts. After some time, the zinc acquires a grey coating, which is rapidly removed by immersing it in dilute acid. The dilute alkali solution in the intermediate cell should be renewed from time to time. No advantage is gained by using potassium hydroxide in place of sodium hydroxide, or sodium dichromate in place of the potassium salt.

C. H. B.

Thermodynamics of Galvanic Polarisation. By MAX LE BLANC (*Zeit. physikal. Chem.*, 1895, **17**, 740—742).—A reply to some criticisms of Jahn and Schönrock (Abstr., 1895, ii, 198).

L. M. J.

Thermo-electric Powers of Metals and Alloys. By JAMES DEWAR and JOHN A. FLEMING (*Phil. Mag.*, 1895, [5], **40**, 95—119.)—The investigations of Tait indicated that in many cases the thermo-electric lines (*d.* E.M.F./*dt*, ordinates; T abscissæ) should be straight lines, so that the curves representing thermo-electromotive force as a function of the temperature should be parabolas. The authors have, therefore, determined the thermo-electromotive force at temperatures as low as the boiling point of liquid air; the couples were in all cases prepared by the junction of the metal wire, "M," with a lead wire, and the observations were afterwards reduced to those of a couple of "M" with *pure* lead. Measurements were taken at about 30 temperatures between 100° and —200° (the temperature being determined by a platinum resistance thermometer, and recorded in "platinum degrees"), and very careful measurements were taken at fixed temperatures, that is, the boiling point of oxygen, melting point of solid carbonic anhydride, &c. The metals examined were platinum, gold, palladium, silver, copper, zinc, cadmium, magnesium, tin, iron, nickel, steel, manganese-steel, manganin, German silver, platinoïd, bismuth (A, B, and C), antimony and aluminium, and also carbon. The lines (E.M.F. against T) are in all cases curved, with frequently a maximum, but none are exact parabolas. Some have changes of curvature, so that the lines of thermo-electric power would be broken, whilst it is noticeable that antimony has two neutral points, and all specimens of bismuth exhibit a sudden break at about −80° *pt.* The authors, however, postpone the complete discussion of the curves and their interpretation. L. M. J.

Electric Resistance of Bismuth at Low Temperatures. By James Dewar and John A. Fleming (*Phil. Mag.*, 1895, [5], **40**, 303—311).—The resistance was determined in the case of three samples of bismuth; 1, commercial pure bismuth (A); 2, and 3, pure samples specially prepared (B and C), the temperature varying from 95° to −235° (platinum degrees). In each case the specific resistance at first diminishes, a minimum being reached at −50° *pt.* (B); −83° *pt.* (C), and 0° (A); after this the resistance increased, the temperature coefficient being negative. In the case of the commercial bismuth (A), a maximum was reached at about −200° *pt.*, after which the temperature coefficient was again positive; but in the two pure samples no such maximum occurred neither was there any indication that a maximum would be reached. It is noticeable that the change in the temperature coefficient of the pure bismuth (especially C), occurs at about the same temperature as that of the discontinuity in the thermoelectric power (see preceding abstract). It is also found that the effect of a magnetic field on the resistance of the metal is very much increased by reduction of temperature; an increase of 5 per cent. due to a magnetic field reaching 25 per cent. at the temperature of liquid air. L. M. J.

Electrical Conductivity and Dissociation Tension of Palladium Hydride. By Alexander Krakau (*Zeit. physikal. Chem.*, 1895, **17**, 689—704).—Considering previous determinations unsatisfactory, the author redetermined the conductivity of the palladium hydrogen alloy, with varying hydrogen content, and also the dissociation tension. The exact quantitative determinations are not recorded, but the author gives as general results that the resistance increases proportionally to the hydrogen until the latter reaches 30 vols., when the rate of increase diminishes gradually until the hydrogen content is 50 vols., after which it is again proportional to the occluded hydrogen. The dissociation tension gave a very similar curve, being proportional to the hydrogen until the latter reaches 40 vols., when the curve bends and becomes almost parallel to the hydrogen axis, and the influence of temperature on the point where this occurs is very slight. The author considers that the results indicate that the hydrogen is at first dissolved in the metal and afterwards when the quantity has reached a required limit, commences to form the compound Pd_2H. L. M. J.

Note by Abstractor.—No mention is made of the researches of Hoitsema (Abstr. 1895, ii, 383), who obtained a curve apparently similar to that of the author, but who considered that the curves were not compatible with the formation of a compound Pd_2H.

Influence of Pressure on the Electrical Conductivity of Solutions. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1895, **17**, 725—736).—The influence of pressure on conductivity may be divided into three factors; (1) volume alteration; (2) alteration of viscosity and ion friction; (3) alteration of the degree of dissociation. The effect of pressure on viscosity has been determined by Cohen (*Ann. Phys. Chem.*, 1892, [2], **45**, 666), for sodium chloride solutions, the viscosity of solutions of small internal pressure diminishes with increase of pressure, the reverse obtaining with solutions of high internal pressure. The effect on the dissociation constant is given in a table of percentage alteration due to pressure of 500 atmospheres for solutions of varying concentration and dissociation. The total effect is then considered and typical curves are given. At infinite dilution, factors 1 and 2 alone are weighty and these cause an increase of about 4·5 per cent. (for 500 atmos.). If the concentration increases, there are three types of curves; (I) where the electrolyte is feebly dissociated, the curve rises to a maximum and slowly falls; (II) where the dissociation is great and factor 3 of small account, the curve is at first almost parallel to the axis of concentration, then slowly sinks owing to the effect of the viscosity, and finally cuts the axis; (III) for intermediate dissociation, the rise is not as rapid as in (I), and a well marked maximum occurs. The curve is also given in the case of sulphuric acid, which is shortly considered; a maximum occurs here at concentration 0·5 per cent. and a minimum at 85 per cent. L. M. J.

Complex Tartrates and Alkaline Solutions of Copper and Lead. By LOUIS KAHLENBERG (*Zeit. physikal. Chem.*, 1895, **17**, 577—619).—The lead potassium and copper potassium double tartrates are first investigated. By the determination of the E.M.F. of a lead | lead acetate | lead potassium tartrate | lead cell, the concentration of the lead ions in the tartrate is found to be $10^{-7\cdot4}$, that is, only a trace of the lead can exist in the ion state in this salt. The molecular weight is found by the freezing point method as 301—400; $PbKC_4H_3O_6 = 393$, but as all potassium salts are strongly dissociated it appears that salt exists as double molecules, whilst evidence of hydrolytic dissociation appears from the great increase of conductivity by dilution. A series of similar experiments with Fehling's solution leads to analogous results for the double tartrate of copper and potassium. The constitution of this salt is most probably represented by $[COOK\cdot CH(OH)\cdot CH(OH)\cdot COOCu]_2O$ with a similar formula for the lead salt. If solutions are prepared by dissolving lead oxide in potassium tartrate in molecular proportion, or by dissolving lead tartrate in potash (1 mol.: 2 mols.), then the whole of the second potash molecule is not present as such in the solution, and the determination of the concentration of the hydroxyl ions by the use of a manganese dioxide electrode proves this, whilst the copper salt is still poorer in hydroxyl ions. It is hence probable that the potassium of the second potash molecule replaces some of the hydroxylic hydrogen of the tartaric acid radicle.

The optical rotation of solutions of sodium, potassium, and lithium tartrates at varying concentrations, and with varying lead oxide content was next determined, and the results shown by curves. In dilute solutions, the addition of lead oxide in all cases, causes a decrease and finally the inversion of the rotation, but with strong solutions the results are not so simple. An interesting result occurs in some of the lithium solutions where dilution produces an increase of rotation. Salts of the tartar emetic type were next examined, that is double tartrates of potassium with boron, antimony, and arsenic oxides. The experiments are not complete, but show great hydrolytic effect, indicate the absence of antimony ions, and suggest doubled formulæ. The effect of organic hydroxy-compounds in preventing the precipitation of copper and lead by potash was investigated, and the resulting solutions examined in the cases of glycollic, lactic, malic, citric, glyceric, tartaric, and salicylic acids, ethylenic glycol, glycerol, erythritol, mannitol, cane sugar and biuret. In all cases, the concentration of the lead or copper ions is extremely small, and the stability of the compound increases with the alcoholic valency. The constitution is uncertain, but probably in some cases the metal enters the hydroxyl group.

L. M. J.

An Iodine Voltameter for the Measurement of Small Currents. By Edward F. Herroun (*Phil. Mag.*, 1895, [5], **40**, 91—94). —The author describes a form of voltameter, especially convenient for the measurement of small currents. The anode consists of a piece of platinum foil, with the leading wire insulated by glass; the electrolyte is a solution of zinc iodide, conveniently prepared by adding potassium iodide to a 15 per cent. solution of zinc chloride, and the cathode consists of a piece of zinc, enclosed in linen or filter paper. The beaker forms a suitable vessel, the anode being at the bottom. The iodine deposited is estimated by sodium thiosulphate (1 c.c. = 0·00657 gram. of iodine = 1 coulomb). The examples given prove the accuracy of the instrument, and the author considers that it possesses the following advantages over ordinary voltameters: (1) freedom from effects of dissolved oxygen, (2) short duration of current necessary, (3) ease and rapidity of estimation and calculation. L. M. J.

Fundamental Atomic Laws of Thermochemistry. By William Sutherland (*Phil. Mag.*, 1895, [5], **40**, 1—56).—Thermochemical data in order to be comparable should be the data relating to the formation, at constant volume, of gaseous products from gaseous elements. To obtain such data, the latent heats of vaporisation are required, and the author, therefore, first gives a number of formulæ by means of which these constants may be calculated, and by their means derives the latent heat per gram-atom due to molecular forces, in the case of the metallic elements, and obtains the generalisation that the latent heat of vaporisation per gram-equivalent, due to molecular force, is approximately a constant or multiple of this constant. The same constants are calculated for a number of halogen compounds by two formulæ, and as the ratio of the results are constant, the relative numbers are probably correct, and the ratio to the actual numbers is obtained by comparison with the directly determined constants in the case of a few chlorides. The heat of formation of inorganic haloïd salts is next calculated, and assuming the value H(RS) (that is the heat of formation of the gaseous compound RS from a gaseous metal, R, and a gaseous halogen S) to be of form $(R) + f(RS) + (S)$, where (R) and (S) depend on R and S simply, and $f(RS)$ on both, the result is obtained that $f(RS) = \psi(R) \,.\, \psi(S)$, and also $(Cl) = (Br) = (I) = 0$. Hence are derived the values (R) for the metals, the numbers being approximately all simple multiples of 3·8.

Various classes of organic compounds are next determined, a similar treatment being adopted; thus, for example (X being any nucleus), the heat of formation of $X{\cdot}CH_2 = (X) + (C) + 2(H) + f(XC) + 2f(CH)$, the value $f(XC)$ is found to be independent of (X), and is hence changed to $f(C{\cdot}C)$. By the use of Thomsen's data (chiefly) the values for different combinations are then found, the results being—

$$\begin{array}{lll}
f(C{\cdot}C) = 14{\cdot}0; & f(C{:}C)) = 14{\cdot}2; & f(C\vdots C) = 0; \\
f(CH) = 15{\cdot}0; & f(C{\cdot}O) = 18{\cdot}5 \text{ and } 15; & f(C{:}O) = 53; \\
f(C{\cdot}N) = 0{\cdot}0; & f(C{:}N) = 0{\cdot}0; & f(C\vdots N) = 0; \\
f(OH) = 29{\cdot}5; & f(O{\cdot}O) = -10{\cdot}0; & f(O{\cdot}N) = 0; \\
f(O{:}N) = 0{\cdot}0; & f(NH) = 3{\cdot}8; & f(SH) = 2{\cdot}5; \\
f(C{\cdot}S) = 0{\cdot}0; & f(C{:}S) = 9{\cdot}0; & f(N{\cdot}N) = 0.
\end{array}$$

Most of the numbers are approximately integral multiples of 3·8, so that this evidence favours the hypothesis that atoms in combining chemically give forth integral multiples of a quantity of heat which may be styled the atomic thermochemical unit. L. M. J.

Specific Heat and Boiling Point of Carbon. By JULES VIOLLE (*Compt. rend.*, 1895, **120**, 868—869).—The following results have been obtained.

1. Above 1000° the mean specific heat of graphite increases regularly with the temperature, in accordance with the formula

$$C_0^t = 0{\cdot}355 + 0{\cdot}00006t.$$

2. The heat given out by 1 gram of solid graphite in cooling from the temperature of volatilisation to 0° is 2050 Cal.

3. The boiling point of carbon is, therefore, 3600°. H. C.

Specific Heats of Superfused Formic and Acetic acids: Apparatus for the Determination of the Specific Heats of Superfused Liquids. By GUSTAVE MASSOL and GUILLOT (*Compt. rend.*, 1895, **121**, 208—210).—Determinations by means of Regnault's thermocalorimeter gave for the specific heat of liquid formic acid between 20° and 80°, 0·517; of the solid acid between 5° and −5°, 0·656; of the superfused acid between 3° and 26°, 0·514, and between

3° and 7°, 0·544. The specific heat of solid acetic acid between 4° and 8° is 0·618, and of the superfused acid between 12° and 21°, 0·473. In both cases, the specific heat is much higher in the solid than in the liquid state; the specific heat of the liquid diminishes with the temperature; the specific heat of the superfused acid is somewhat higher than that of the liquid, but is of the same order of magnitude. The results are similar to those obtained by Bruner (Abstr., 1895, ii, 378) with thymol and paracresol.

The range of applicability of Regnault's thermocalorimeter may be greatly increased by constructing it after the manner of Walferdin's thermometer, and using mercury, sulphuric acid, or some other liquid boiling at a high temperature instead of alcohol. C. H. B.

Determination of the Critical and Boiling Temperatures of Hydrogen. By KARL OLZEWSKI (*Phil. Mag.*, 1895, [5], **40**, 202—210; and *Ann. Phys. Chem.*, 1895, [2], **56**, 133—143).—Experiments were performed in order to directly determine the critical temperature of hydrogen by compressing the gas at the temperature of boiling oxygen, and then allowing the pressure to fall to the critical pressure (20 atmos.). In a similar manner, by allowing the pressure to fall to 1 atmos. the boiling point could be determined. A platinum resistance thermometer was employed, the metal wire being very fine (0·025 mm.), in order that it might immediately assume the temperature of the gas. This thermometer was compared with the hydrogen thermometer at 0°, −78·2°, −182·5°, and −208·5°, the results below this being obtained by extrapolation. The critical temperature so obtained is −234·5°, and the boiling point −243·5°. The availability of the method is shown by experiments with oxygen, when the values −118° to −119·2°, and −181·3° to −182·5° were obtained for the critical and boiling temperatures; the determinations obtained otherwise by the hydrogen thermometer being −118·8° and −181·4° to −182·7°. (See also Abstr., 1895, i, 397.) L. M. J.

Some Relations between Temperature, Pressure, and Latent Heat of Vaporisation. By CHARLES E. LINEBARGER (*Amer. J. Sci.*, 1895, [3], **49**, 380—396).—The constancy of the quotient of the molecular heat of vaporisation by the absolute temperature at which the vaporisation takes place, or what is commonly known as Trouton's law, has been arrived at in different ways. Still there exist certain discrepancies between the theory and the experimental determination which must be accounted for. Taking all the trustworthy determinations into consideration, it is found that some 70 liquids give an average value for the constant of 20·70, the extreme values being 19·58 and 22·04. But the alcohols, the acids and the nitro-compounds, as well as water and acetone, form exceptions to this rule, the values for the acids and nitro-compounds being too small, and for the alcohols, water and acetone, too large. The cause of this abnormal behaviour is to be found in the association of the molecules of these liquids, as shown by Ramsay, and in the changes which the molecular aggregations undergo during the process of vaporisation.

In the case of the alcohols, water and acetone, the experiments of

Ramsay show that the liquids are made up of molecules in a state of association. On the other hand, the normality of the vapour density and other properties of the vapours of these liquids, show that they consist exclusively of simple molecules. Accordingly, when the liquids are evaporated, there occurs a decomposition of the complex molecules into simpler ones. The heat necessary to convert a molecularly polymerised liquid into its normal vapour consists then of two terms, the heat expended in actually turning the liquid into a gas, and the heat used up in decomposing the molecular aggregations. The molecular heat of vaporisation, and, consequently the constant, becomes greater than the normal, and indeed so much the greater the more complex the liquid molecule.

The case of the acids is different, as here we have reason to suppose that the density of the vapour is abnormal, and that the liquid associated molecule does not undergo much change in passing into the gaseous state. The molecular heat of vaporisation, if calculated from the normal molecular weight, is therefore too low, and the constant only approximates to 20·7, when the mass of the associated molecule is substituted for that of the normal molecule. A similar thing probably holds for the nitro-compounds.

These considerations indicate a method of getting an approximation to the degree of association of a liquid. If any liquid, whose latent heat of volatilisation is known, gives a value for the constant close to 20·7, it is pretty certain that it is normal. If it gives a less value, it is associated in the liquid as well as in the gaseous state; if it gives a greater value, it must be associated in the liquid state alone.

H. C.

The Condensation and the Critical Phenomena of Mixtures of Ethane and Nitrous Oxide. By Kuenen (*Phil. Mag.*, 1895, [5], **40**, 173—194).—The results are recorded of experiments on the critical phenomena of various mixtures of the two gases. The ethane was obtained in as pure a state as possible, the foreign admixture being estimated as far below 0·1 per cent.; its critical temperature was 31·95 to 32·05, which is, however, considerably below that of other observers. The critical temperature of the nitrous oxide was 35·95 to 36·05, and the impurity was estimated as below 0·0002. The critical temperatures of the mixtures were found, for the most part, to lie below those of either constituent, thus, 0·1 of ethane lowers the critical temperature to 32°, and a minimum of 25·8° occurs at 0·5 of ethane. The pressures of some of the mixtures are above those of nitrous oxide, a maximum pressure being obtained for 0·2 of ethane, this maximum remaining up to the critical point. In the case of a number of the mixtures, those between 0·2 and 0·5 of ethane, the interesting phenomenon is observed of what the author names "retrograde condensation of the second kind," that is, by compression a vapour phase appears, which begins by increasing, then reaches a maximum, diminishes, and again disappears. The probable occurrence of such a, previously unobserved, phenomenon is discussed and predicted in the first portion of the paper, and its realisation was the chief object of the author's experiments.

L. M. J.

Thermochemistry of Cyanuric acid. By Paul Lemoult (*Compt. rend.*, 1895, **121**, 351—354).—Cyanuric acid, contrary to the usual statements, is comparatively insoluble in water, 1000 c.c. at 8° dissolving only 1·5 gram, the solubility increasing slowly with the temperature.

The heat of combustion of the anhydrous acid is 1715·85 Cal., and its heat of formation −165·06 Cal.; heat of dissolution, −3·2 Cal.; heat of hydration, +0·88 Cal.

The heat of formation of the hydrated acid, $C_3N_3O_3H_3 + 2H_2O$, from its elements is +165·9 Cal.; heat of dissolution, −6·88 Cal.

Cyanuric acid is neutral to "methyl-orange," acid to phenolphthaleïn and to litmus, and does not affect the blue CBBBB. Phenolphthaleïn becomes violet when the acid is converted into a monosodium salt, and the blue, CBBBB, is decolorised when the disodium salt is formed. The heat of neutralisation by sodium hydroxide is +6·78 for the first equivalent, +4·32 for the second, and 1·72 for the third, whilst a fourth equivalent of the alkali develops from 0·15 to 0·5 Cal. With potassium hydroxide, the three equivalents develop, respectively, +6·8, +4·2, and +2·0 Cal. If potassium hydroxide is added to a solution of monosodium cyanurate, the first equivalent develops +4·1 Cal., the second +2·0 Cal., and the third 0·2 Cal.

With ammonia the results are different, and are analogous to those obtained with phosphoric acid; the three successive developments of heat are +6·1, +1·65, and +1·0 Cal. In presence of ammonia, the cyanuric acid retains its power of combining with potassium and sodium hydroxides.

These results indicate that, like phosphoric acid, cyanuric acid is an acid of mixed function,

$C_3 + N_3 + O_3 + K_3 + Aq = C_3N_3O_3K_3$
diss. .... develops +318·3 Cal.
$C_3 + N_3 + O_3 + K_3 + Aq = 3CNOK$
diss. .... „ +397·1 „

hence the heat of transformation of 3 mols. of dissolved potassium cyanate into 1 mol. of dissolved potassium cyanurate is +27 Cal.

C. H. B.

Thermochemistry of Alkali Cyanurates. By Paul Lemoult (*Compt. rend.*, 1895, **121**, 375—378).—Sodium cyanurate, $C_3N_3O_3H_2Na + H_2O$, crystallises in small, white needles, which can only be obtained anhydrous by passing dry air over the finely powdered salt heated at 120—140°. Heat of dissolution of the hydrated salt, −4·91 Cal.; of the hydrated salt, −8·86 Cal.; heat of formation of the hydrate (solid water), +2·55 Cal. The heats of dissolution are independent of the degree of dilution, and consequently the salts are not dissociated by water.

$C_3N_3O_3H_3$ sol. + NaOH diss. = $C_3N_3O_3H_2Na$
sol. + H_2O liq. .... develops +8·45 Cal.
$C_3N_3O_3H_3$ sol. + NaOH diss. = $C_3N_3O_3H_2Na,H_2O$
sol. .... „ +12·40 „

The disodium salt forms silky, anhydrous needles; the heat of dissociation is −1·78 Cal., and is independent of the degree of dilution,

$C_3N_3O_3H_3$ sol. + $2NaOH$ diss. = $C_3N_3O_3HNa_2$
diss. + $2H_2O$ liq. .... develops +9·44 Cal.

The trisodium salt also crystallises in anhydrous needles; the heat of dissolution is +1·47 Cal., and is independent of the degree of dilution; heat of formation from acid and alkali, +7·93 Cal.

The monopotassium salt crystallises with 1 H_2O, which it readily loses at 130°. Heat of dissolution of the anhydrous salt, −8·57 Cal.; of the hydrated salt, −10·85 Cal.; heat of hydration (solid state), +0·88. Heat of formation of the solid anhydrous salt from acid and alkali, as above, +12·17 Cal., and of the solid, hydrated salt, +14·45 Cal.

The dipotassium salt is anhydrous; heat of dissolution, −5·9 Cal. heat of formation from acid and alkali, +13·7 Cal.

Attempts to isolate tripotassium cyanurate were not successful, and it would seem that even in solution the formation of this salt is incomplete.

The potassium salts, like the sodium salts, are not decomposed by water. C. H. B.

Heats of Combustion of some β-Ketonic Ethereal Salts. By J. Guinchant (*Compt. rend.*, 1895, **121**, 354—357).—The compounds were burnt in the calorimetric bomb.

	Heat of combustion.		
	Constant volume.	Constant pressure.	Heat of formation.
Acetylacetone	615·8	616·3	131·2
Methylic cyanacetate..........	472·1	471·9	77·8
Methylic cyanacetoacetate......	685·5	685·3	122·0
Ethylic cyanacetate...........	629·5	629·7	83·3
Ethylic cyanacetoacetate.......	836·8	837·0	133·6
Methylic malonate	552·5	552·5	195·0
Methylic acetylmalonate.......	753·2	753·2	251·9
Ethylic diacetoacetate.........	971·9	972·4	196·0
Methylic acetoacetate..........	593·6	594·0	153·5

In these compounds, the substitution of acetyl for hydrogen raises the heat of combustion by somewhat less than 225 Cal. As in the case of carboxylic acids, the formation of these acid derivatives from their elements is accompanied by an excessive expenditure of energy, a result probably due to the conversion of the acetyl group into the enolic group, $CH_2{\cdot}COH$.

The heats of combustion of these compounds are, as a rule, lower than those of the carboxylic acids of the same composition and molecular weight. C. H. B.

Heat developed by Alcoholic Fermentation. By A. Bouffard (*Compt. rend.*, 1895, **121**, 357—360).—Adopting Berthelot's values for the heats of combustion, and Pasteur's equation for the fermentation of sugar, the total heat developed by the fermentation of each molecule of sugar, $C_6H_{12}O_6$, should be 32·07 Cal. Direct determination gives for 180 grams of sugar, +23·5 Cal., which is considerably below the calculated number; but the difference may be due to errors of experiment. The heat developed lies, however, between 24 and 32 Cal., and it is not necessary to assume so large a development as +71 Cal. in calculating the dimensions of refrigerators. An apparatus using a volume of water equal to half, or to the whole, volume of the wort, ought to suffice in most cases.

C. H. B.

The Dependence of the Volume of Solutions on Pressure. By Gustav Tammann (*Zeit. physikal. Chem.*, 1895, **17**, 620—636).—Tait's researches on the compressibility of water led to the expression $\Delta v/\Delta p = A/(B + p)$, A and B depending on the temperatures, and for salt solutions he derived the relation $\Delta v/\Delta p = A(B + p + am)$, where m is the quantity of salt dissolved. This expression, however, is only available for dilute solutions, but the volume relations of any solution may be obtained from the internal pressure. If, by solution, the internal pressure increases from κ to $\kappa + \Delta\kappa$, then the volume is that of the solvent at pressure $p = \Delta\kappa$. Hence $\Delta v = \int_o^p dv/dp \,.\, dp$ and $v_p = v_o(1 - \int_o^p dv/dp \,.\, dp$. Similarly, the alteration of volume which a solution of internal pressure $\kappa + \Delta\kappa$ experiences, owing to external pressure p, is equal to the volume alteration of solvent due to increase of external pressure from $p_1 (= \Delta\kappa)$ to $p_1 + p$. For aqueous solutions the volume of the solvent is calculable from Tait's expression, $v_p = v_o[1 - A \log (B + p/B)]$. Absolute agreement between calculated and experimental numbers is not to be expected, as the assumption is made that $\Delta\kappa$ is not altered by the pressure, and that no chemical change occurs. The values of v_p for water are first compared with the experimental determinations of Amagat; the agreement is close, the calculated values being probably the more accurate. The calculated and observed values (Tait's) are then compared in the cases of solutions of sodium chloride, magnesium sulphate, ammonium sulphate, potassium iodide, and barium chloride for pressures up to 457 atmos., and the results agree within 3 per cent. of the total volume alteration. The expression is also tested by means of Röntgen's and Schneider's determinations, and its validity again established (Abstr., 1895, ii, 307).

L. M. J.

Solubility of Mixed Crystals. Willem Stortenbeker (*Zeit. physikal. Chem.*, 1895, **17**, 643—650).—The various cases of solubility curves of mixed hydrated crystals are illustrated, the molecular percentages of the two constituents serving as ordinates and abscissæ. The curve may be continuous or it may exhibit breaks, owing to mixtures existing in a labile state. Three classes of curves are illustrated. (1) The solubility isothermals do not cut as in the case of

$MgSO_4,7H_2O$, $ZnSO_4,7H_2O$ and $MgSO_4,6H_2O$, $ZnSO_4,6H_2O$; here the isothermal of the latter series is throughout labile, and lies outside that of the more hydrated crystals. (2) The isothermals cut as in the case of $CuSO_4,5H_2O$, $FeSO_4,5H_2O$ and $CuSO_4,7H_2O$, $FeSO_4,7H_2O$. As when the curves cut, that nearer the origin is the more stable, there are two partial curves for the stable form. Similarly, if the isothermal itself has a break, the curve may consist of three broken portions. The curves for three classes of mixed crystals are also illustrated, but in this case the variety of forms is very great. L. M. J.

Estimation of the velocity of Chemical Attraction. By Nicolae Teclu (*J. pr. Chem.*, 1895, [2], **52**, 277—284).—The flame of a mixture of inflammable gases, such as hydrogen and oxygen, remains stationary when the velocity of the mixed gases is equal to the rate at which the gases combine; and if the mixture consists of equivalent masses of the combining gases, this rate of combination must bear some ratio to the time which elapses while the atoms are coming within the sphere of their mutual attraction. Measurements of this rate of movement cannot be made with any degree of accuracy when the combustion is occurring in a tube, because a variety of conditions, for instance, the enhanced temperature and the presence of the product of the combustion, affect the results. The author has sought to measure the rate of issue of hydrogen from a jet into air and of air from the same jet into hydrogen at the moment when the gas ignites at the jet, the ignition being effected by a small gas flame held immediately below the issuing stream of gas at a point 1 cm. from the jet. This rate of issue should be a measure of the velocity of attraction of hydrogen for oxygen on the one hand and of oxygen for hydrogen on the other hand.

The hydrogen, or air, was confined in a vessel over water at a pressure of about 300 mm. of mercury. A stopcock controlled the rate of issue of the gas from the jet, and a manometer enabled the pressure in the vessel to be recorded at the desired moment. The diameter of the jet was 0·291 mm. To create an atmosphere of hydrogen around the jet when the vessel contained air, a hydrogen delivery tube, terminating in a slit 2 mm. wide and 6 mm. long, was held with the length of the slit parallel to and immediately below the stream of issuing gas, so that the latter passed through the slow stream of hydrogen on its way to the ignition flame.

The rate of issue of the gas is calculated from the formula

$$v = \sqrt{2g\frac{h - h_1}{s}},$$

where v = velocity of the gas in metres per second,
g = gravity constant (9·8085 at Vienna),
h = pressure of issuing gas in metres of air,
h_1 = pressure of gas into which the issue occurs, in metres of air.
s = specific gravity of issuing gas.

As a mean of ten observations of pressure, in as many experiments, the value $v = 813{\cdot}71$ was obtained for hydrogen issuing into air. Taking the volume of the air as 4·8204 times that of the oxygen contained in it, and multiplying by the contraction-coefficient (0·8), v becomes 3137·93 metres per second, and represents the velocity of attraction (*Attractions-Geschwindigkeit*) of hydrogen for oxygen.

In another series of observations in which air issued into hydrogen, the velocity of attraction of oxygen for hydrogen, similarly calculated, was found to be 774 metres per second.

Embodying the above velocities in the kinetic energy equation $E = mv^2\frac{1}{2}$, the values 4923522 metre-kilos. and 4792608 metre-kilos. are obtained for the chemical atom-energy of hydrogen and oxygen respectively; these values may be regarded as representing a constant. By substituting the former value for E in the equation, the value of v for any other gas may be ascertained. The chemical atom-energy constant being known, the energy value of any combination may be calculated; thus the combination of hydrogen and chlorine consisting in a union of two atoms, its energy value per kilo. of hydrogen should be 2 × 4923522 metre-kilos, or 9847044 ÷ 424 = 23224 Cal. The determined value is 23783 Cal. A. G. B.

Equilibrium in the System $HgO—SO_3—H_2O$. By C. HOITSEMA (*Zeit. physikal. Chem.*, 1895, **17**, 651—677).—The three components of this system may form the solid compounds $HgSO_4$; HgO,SO_3,H_2O; $3HgO,2SO_3,2H_2O$; and $3HgO,SO_3$, the latter being well known as turpeth mineral. The compound $4HgO,SO_3$, stated to occur, could not be prepared by the authors. The determination of the equilibrium relations were performed by adding the solid compounds to acids of various concentrations in a flask maintained at a constant temperature (25° or 50°), and kept in rotation for three hours, after which portions of the solution were withdrawn and analysed. The first branch of the 25° curve is that with $3HgO,SO_3$ as solid phase, and here the HgO and SO_3 molecular percentage increases from 1·2 and 0·33 to 4·3 and 2 respectively; at this point, the curve cuts the second branch, for which the solid phase is $3HgO,2SO_3,2H_2O$. Here the molecular percentage of HgO varies but slightly with increasing acid content, so that the curve drawn with the percentages of HgO as ordinates is almost horizontal. In three cases, a labile equilibrium was obtained, the $3HgO,SO_3$ solid phase persisting. The second curve cuts that of the solid phase HgO,SO_3,H_2O at 6·77 per cent. SO_3 and 2·02 per cent. HgO, which phase persists to 8·1 per cent. SO_3, 0·6 per cent. HgO. The quantity of the oxide dissolved becomes for this curve very small with increasing acid content. The results also, where comparable, agree very satisfactorily with those of Le Chatelier. In the observations at 50°, the third branch disappears and the other branches show a region in which phases 1, 2; 2, 4; and 4, 1 may coexist, while the curves further indicate that solutions of turpeth mineral and of $HgSO_4$ as solid phase will precipitate the solid by warming, but this does not hold for cases in which the solid phase is $3HgO,2SO_3,2H_2O$ where increase of temperature causes a transition to either $3HgO,SO_3$ or to $HgSO_4$. A similar transition from $HgSO_4,H_2O$ to $HgSO_4$ also evidently occurs. Since a line equidistant from the two axes does not cut branch 4, it is evident that the compound $HgSO_4$ is not soluble in water without decomposition. The paper concludes with a short discussion of possible causes of this decomposition and of the hydrolytic formation of the basic salt, $3HgO,SO_3$. L. M. J.

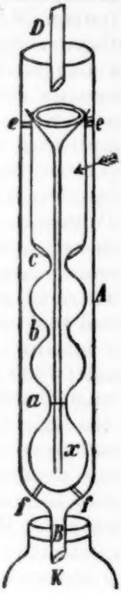
The Colour of the Ions as a Function of the Atomic Weight. By JULIUS THOMSEN (*Zeit. anorg. Chem.*, 1895, **10**, 155).—With regard to the arrangement of the elements in a periodic system, described by Carey Lea (Abstr., 1895, ii, 441) on the basis of the colour of the ions, the author points out that the form of the periodic system published by him (*Zeit. anorg. Chem.*, 1892, **9**, 192) is in accordance with a very simple relation between the colour of the ions and the atomic weights. Those ions only are coloured which belong to the middle members of the large series. The two first series, with 7 members, contain no coloured ions; the two next, with 17 members, contain in each series 7 to 8 coloured ions (titanium to copper and niobium to silver), and in the 5th series, with 31 members, the group with coloured ions (cerium to gold) is in the middle of the series. E. C. R.

Supposed Group of Inactive Elements. By JULIUS THOMSEN (*Zeit. anorg. Chem.*, 1895, **9**, 283—288).—If the chemical character of the elements is a periodic function of the atomic weights, such a function must follow the ordinary general laws. In periodic functions, the change from negative to positive values or the reverse can only take place by a passage through zero or through infinity; in the first case the change being a gradual and in the second case a sudden one. The first case corresponds with the gradual change in electrical character with rising atomic weight in the separate series of the periodic system, and the second case corresponds with the passage from one series to the next. It therefore appears that the passage from one series to the next in the periodic system should take place through an element whose electrical character is $\pm\infty$, and which is therefore electrically indifferent. The valency of such an element would be zero, and therefore in this respect also it would represent a transitional stage in the passage from the univalent electronegative elements of the seventh to the univalent electropositive elements of the first group. This indicates the possible existence of a group of inactive elements with the atomic weights 4, 20, 36, 84, 132, and 212. H. C.

Argon, Prout's Hypothesis and the Periodic Law. By EDWIN A. HILL (*Amer. J. Sci.*, 1895, [3], **49**, 405—417).—If argon be an element, its properties indicate that its place in the periodic classification is between fluorine and sodium, with an atomic weight of 20. Yet the specific heat ratio of 1·66 points to an atomic weight of 40, if such a ratio necessarily involves monatomicity. The weak point in the assumption that it does, lies in the view taken that the molecular encounter involves actual contacts, which is not a necessary assumption in the kinetic theory of gases. The greater the force of aggregation, and the smaller the distance between the atoms compared to the imaginary molecular diameter or least distance of approach, the less the tendency for internal rotation.

The author points out that in the determinations of the combining ratio of hydrogen and oxygen, there is great probability of the hydrogen used, or of the water formed having been contaminated with argon. The effect of this would be to decrease the value for oxygen, so that the atomic weight would approximate to 16, the whole number required by Prout's hypothesis. H. C.

A New Extraction Apparatus. By J. J. L. van Rijn (*Ber.*, 1895, **28**, 2387).—The apparatus, consisting of a wide glass tube, *A*, and an extraction vessel, *C*, supported at *e* and *f*, is intended for the extraction of liquids, and is so arranged that the extraction is carried out at a temperature close to that of the boiling point of the extracting liquid. The vapour condenses in *D*, drops into the funnel tube, and bubbling up through the liquid in the bulb *x*, ultimately runs out through the holes at *c*, back into the extraction vessel *K*. A. H.



Inorganic Chemistry.

Conversion of Chlorine into Hydrogen Chloride. By Richard Lorenz (*Zeit. anorg. Chem.*, 1895, **10**, 74—77).—Chlorine is completely converted into hydrogen chloride by passing it, mixed with steam, through a tube filled with coke, and heated to a faint red heat. The action is expressed by the equation $2Cl + H_2O + C = 2HCl + CO$, and so complete is it that the gases issuing from the hot tube do not contain sufficient chlorine to give a reaction with potassium iodide and starch. After absorption of the hydrogen chloride by means of water, the residual gas is almost pure carbonic oxide, containing only a very small quantity of carbonic anhydride.

E. C. R.

Crystallisation of Bromine. By Henryk Arctowski (*Zeit. anorg. Chem.*, 1895, **10**, 25—26).—Bromine crystallises from a very concentrated solution in carbon bisulphide at −90° in slender, carmine red needles, having a somewhat similar appearance to chromic anhydride. The crystals are pure bromine. Bromine, when sufficiently cooled, solidifies to a dark brown mass, which has a crystalline fracture, but not so well defined a metallic lustre as iodine.

E. C. R.

Compound of Selenium with Arsenic. By A. Clever and Wilhelm Muthmann (*Zeit. anorg. Chem.*, 1895, **10**, 117—147).—The authors attempted to prepare compounds of arsenic acid in which the oxygen is partially replaced by selenium. For this purpose, arsenious acid dissolved in concentrated potassium hydroxide was mixed with selenium, also dissolved in potassium hydroxide. A complicated reaction takes place, a small quantity of selenium is deposited, but the only compound which the authors were able to isolate was a potassium polyselenide, described below.

Potassium oxyselenoarsenate, $K_6As_2Se_5O_3 + 10H_2O$, is obtained by treating arsenic pentaselenide with potassium hydroxide. The arsenic pentaselenide (5 grams), prepared by melting a finely ground mixture of arsenic and selenium in a porcelain crucible, is gradually added to a concentrated solution of potassium hydroxide (10 grams), the mixture being cooled with ice; it is then filtered into absolute alcohol (300 c.c), and the orange-red, crystalline mass thus obtained is washed with alcohol and dried on a porous plate. It is analogous to the salt $Na_6As_2S_3O_5 + 24H_2O$, described by Geuther. It rapidly decomposes and darkens on exposure to air and moisture, selenium being deposited; it dissolves easily in water, forming a greenish-yellow solution, and then decomposes rapidly with deposition of red selenium. With salts of the heavy metals it gives dark, amorphous precipitates; with barium salts, a reddish-white compound, which decomposes very rapidly. When treated with acids, it yields arsenic pentaselenide.

Arsenic pentaselenide, As_2Se_5, prepared by melting its constituents together, has properties similar to those of Ülsmann's triselenide. When heated in the air, it decomposes, and red selenium and a greyish-black sublimate are formed. If prepared by decomposing the preceding compound with acid, it forms a reddish-brown powder. It dissolves to a greenish-red solution in alkalis and ammonia, and is reprecipitated unchanged by acids; it is insoluble in dilute acids and concentrated hydrochloric acid, and is slowly decomposed by warm, dilute nitric acid, very rapidly by cold, fuming nitric acid, whereby arsenic and selenious acid are formed. It is insoluble in water, alcohol, ether, and carbon bisulphide, and has neither taste nor odour.

Potassium metaselenoarsenate, $KAsSe_3 + 2H_2O$, is obtained by adding arsenic pentaselenide to a solution of selenium in potassium hydroxide; the mixture, after being heated for some time, is filtered into alcohol, a small quantity of water is added, in order to dissolve other compounds which are formed at the same time, and the product is then dried on a porous plate. It crystallises in reddish-yellow prisms, and is easily soluble in hot water, but the solution soon decomposes, with deposition of selenium; alkaline solutions are somewhat more stable. Acids precipitate arsenic pentaselenide from the aqueous solution with evolution of hydrogen selenide. With lead and silver salts, it gives a black precipitate; with barium salts, a reddish-white precipitate, which rapidly decomposes.

Potassium thioselenoarsenate, $K_6As_2Se_5S_3 + 12H_2O$, is prepared by adding arsenic pentasulphide to a solution of potassium sulphide, heating the mixture to boiling, and filtering the solution into alcohol; the compound then crystallises out in orange-red needles. It is unstable on exposure to air and moisture, melts to a reddish-yellow liquid at the warmth of the hand, and is fairly stable in aqueous solution; the aqueous solution, when treated with acids, gives a brownish-red precipitate of the pentaselenide mixed with sulphur, hydrogen sulphide being evolved.

Sodium oxyselenoarsenate, $3Na_2Se,3Na_2O,As_2O_5 + 50H_2O$, is obtained by warming arsenic pentaselenide with a concentrated solution of sodium hydroxide; a new hydrate of sodium monoselenide, described below, is at first precipitated, but on filtering, and mixing the filtrate with alcohol, the oxy-compound crystallises out in white, elongated prisms, which are fairly stable on exposure to air. It is easily soluble in water; acid precipitates selenium from the solution and an arsenic selenide is not formed. With lead and silver salts, it gives a black precipitate; and with barium chloride, a white, amorphous precipitate which is easily soluble in warm water.

Sodium selenoarsenite, $Na_3AsSe_3 + 9H_2O$, is formed together with other salts when arsenic pentaselenide is boiled with a solution of selenium in sodium hydroxide; on concentrating the filtered solution in a vacuum, a mixture of white needles and orange-red tetrahedra is obtained. On separating these by levigation, a small quantity of the tetrahedra are obtained. It is unstable on exposure to air, becoming coated with grey selenium; it is easily soluble in water, and the brown solution when treated with dilute acids gives a brownish-red precipitate with evolution of hydrogen selenide.

Sodium thioselenoarsenate, $Na_6As_2Se_5S_3 + 18H_2O$, prepared in a similar way to the corresponding potassium salt, crystallises in golden-yellow spangles, or in beautiful, long needles which are fairly stable, but slowly darken and decompose on exposure to air. It is easily soluble in water; and acids precipitate a brown compound from the dark-brown solution with evolution of hydrogen sulphide; towards acids and salts of the heavy metals, it behaves like the potassium salt.

Potassium triselenide, $K_2Se_3 + 2H_2O$, is obtained, as previously stated, in brown needles, when potassium selenide is mixed with arsenious acid dissolved in alkali; the crystals rapidly decompose and become coated with grey selenium on exposure to air. It dissolves in water, and the solution when treated with acids, yields selenium and hydrogen selenide.

Sodium monoselenide, $Na_2Se + 10H_2O$, obtained as mentioned above, crystallises in beautiful white needles which rapidly turn red, then brown, and become coated with grey selenium; it is easily soluble in water, but insoluble in alkali hydroxides. It evolves hydrogen selenide on exposure to the air, or when treated with dilute acids; melts to a brown liquid when warmed, and has the properties assigned to the sodium selenide obtained by Fabre. E. C. R.

Helium and Argon. By HEINRICH KAYSER (*Chem. News*, 1895, **72**, 89).—The author records the discovery of helium in the free state in nature. In the springs of Wildbad, in the Black Forest, bubbles of gas rise up, which, according to an old analysis of Fehling, contain

96 per cent. of nitrogen. An analysis of this gas showed that after sparking with excess of oxygen and removal of the residual oxygen with pyrogallol, a residue was obtained which gave the spectra of argon and helium, the latter being evidently present in quantity. Runge and Paschen found two substances in the gas from clèveite and bröggerite, and both these elements appear to be represented in the Wildbad gas. As a place has here been found in which the two gases represented by the name helium are liberated and stream into the atmosphere, it follows that these must be normally present in the atmosphere. The author has found this to be the case, and that argon prepared from the air of Bonn contains helium, the presence of the D_3 line in the spectrum being most marked. H. C.

A Possible Compound of Argon. By WILLIAM RAMSAY (*Chem. News*, 1895, **72**, 51).—By making an arc between two thin carbon rods, in an atmosphere of argon for some four hours, the volume of the gas increased about one-fifth, and was not altered by exposure to water, to caustic soda, or to ammoniacal cuprous chloride. It gave, in addition to a faint argon spectrum, a luminous, finely channelled spectrum, with certain lines not coincident with argon lines (see Crookes, this vol., ii, 2). D. A. L.

Fluorides and Oxyfluorides of Potassium. By G. MARCHETTI (*Zeit. anorg. Chem.*, 1895, **10**, 66—73).—Anhydrous potassium titanofluoride, K_2TiF_6, is prepared by adding the theoretical quantity of potassium hydrogen fluoride to a solution of titanium dioxide in an excess of hydrogen fluoride. It crystallises in small, very lustrous leaflets, which are denser than the crystals of the hydrated fluoride, K_2TiF_6,H_2O. It can be crystallised without change from hot hydrofluoric acid, but when dissolved in water it is completely converted into the hydrated salt. Conversely, when the hydrated salt is dissolved in concentrated hydrofluoric or hydrochloric acid, it is converted into the anhydrous salt.

The normal potassium fluoride compounds of niobium, molybdenum, and tungsten, of the formulæ $NbO_2F_2,2KF,H_2O$, $MoO_2F_2,2KF,H_2O$, and $WO_2F_2,2KF,H_2O$, respectively, behave in the same way.

The oxyfluoride of molybdenum, $MoO_2F_2,2KF,H_2O$, obtained by adding the theoretical quantity of potassium hydroxide to a solution of molybdic anhydride in hydrofluoric acid, taking care that the mixture remains acid, crystallises from hot hydrofluoric acid in short, lustrous prisms of the composition $MoO_2F_2,2KF$. The salt described by Delafontaine (*Arch. Sci. Phys.*, 1867, **30**, 244), MoO_2F_2,KF,H_2O, is probably a mixture of the two preceding salts, and, according to the author's results may also contain the oxyfluoride $MoOF_4,KF$.

The double fluoride of tungsten, $WO_2F_2,2KF,H_2O$, is obtained in a similar way to the molybdenum salt. The anhydrous salt crystallises in groups of large tablets. E. C. R.

Some Alkali Phosphides. By C. HUGOT (*Compt. rend.*, 1895, **121**, 206—208).—When liquefied ammonia is brought in contact with a mixture of known quantities of red phosphorus and sodium or potassium, the sodammonium or potassammonium which is first formed is decomposed by the phosphorus with liberation of hydrogen, and the product remains in solution in the excess of ammonia. Potassium yields a red compound, $P_5K,3NH_3$, which when heated at 180° loses all its ammonia, and leaves a brownish-red mass of the phosphide, P_5K. Sodium yields a red product, $P_3Na,3NH_3$, which at 180° loses all its ammonia, and leaves the phosphide P_3Na. The potassium compound is not obtained quite pure, since potassamide is slightly soluble in liquefied ammonia, but this difficulty is not experienced in the case of the sodium compound. Both phosphides are decomposed by moist air, with liberation of hydrogen phosphide. Their other properties will be described subsequently.

C. H. B.

Determination of the Atomic Weight of Zinc. By Theodore W. Richards and Elliot F. Rogers (*Zeit. anorg. Chem.*, 1895, **10**, 1—24).—The authors have determined the atomic weight of zinc from the ratio of silver to zinc bromide and silver bromide to zinc bromide.

The specific gravity of zinc bromide was found to be 4·219 at 20°. The zinc bromide employed in the first series of determinations was prepared by dissolving pure zinc oxide in pure hydrogen bromide, the pure zinc oxide being prepared by dissolving commercially pure zinc in dilute sulphuric acid, and allowing the solution to remain some weeks in contact with an excess of the metal. The filtered solution is then slightly acidified with sulphuric acid and treated with pure hydrogen sulphide until a considerable quantity of pure white precipitate is formed, and the filtrate from this is treated with chlorine water and fractionally precipitated with pure soda. The first precipitate, which contains iron and manganese, is discarded, but the second precipitate after being well washed with water, is dissolved in pure nitric acid, treated with an excess of zinc carbonate, and filtered; the filtrate is treated with a small quantity of ammonium carbonate, and, after filtration, the zinc is precipitated with ammonium carbonate. The basic zinc carbonate thus obtained is washed, heated in a platinum crucible by means of a spirit flame, and again washed and dried. The hydrogen bromide was prepared according to well-known methods, and purified by fractional distillation.

In the determination of the atomic weight, great care must be taken that the zinc bromide is free from every trace of water; the method employed is that already described by the author for the analysis of strontium bromide (Abstr., 1895, ii, 314). The pure recrystallised or sublimed zinc bromide is heated for some time in a platinum boat in a current of nitrogen containing hydrogen bromide, by which means all the water is removed without the slightest formation of oxybromide; the dry salt is then quickly transferred to a desiccator and weighed. It is dissolved in water, precipitated with a slight excess of silver dissolved in nitric acid, and the silver bromide thus obtained is collected in a Gooch's crucible, and weighed. In a second series of determinations, the filtrate was concentrated, and the excess of silver determined by precipitation with hydrobromic acid. The first series of five experiments gave Zn = 65·459. The second series of four experiments gave Zn = 65·430 from the ratio $Ag_2 : ZnBr_2$, and Zn = 65·425 from the ratio $2AgBr : ZnBr_2$. The silver bromide obtained in the last four experiments gave 57·444 per cent. Ag, which shows that the hydrogen bromide employed was free from chlorine and iodine, and that the precipitate contained no included zinc bromide.

In the third series of experiments, the zinc bromide was prepared by dissolving pure electrolytic zinc in pure bromine. A solution of zinc sulphate is prepared as described above, but after the treatment with chlorine, pure soda is added, until a small precipitate is formed, and the mixture is allowed to remain for some days, shaking occasionally; the precipitate is then filtered off, and the zinc sulphate crystallised from hot water. The solution of this zinc sulphate after being allowed to remain two days in contact with pure electrolytic zinc in a platinum dish, is filtered, treated with ammonia, and electrolysed with a current of 1 to 1½ ampères; the zinc crystals formed being washed with ammonia, then with hydrochloric acid, and finally with water. The zinc is then dissolved in bromine, the solution filtered through asbestos, and the excess of bromine eliminated by heating on the water bath; finally the zinc bromide is either sublimed or distilled in a special apparatus which is figured in the original paper, and so arranged that the sample to be analysed is collected in platinum vessels. The zinc bromide is first dried at a gentle heat in an atmosphere of carbonic anhydride, then at a temperature slightly above its melting point in carbonic anhydride mixed with hydrogen bromide, and finally at 150° in a current of air until the exit gases show no trace of carbonic anhydride or hydrogen bromide. It is then weighed, dissolved in water, and precipitated in the dark with silver dissolved in nitric acid; two equivalent solutions of silver and hydrogen bromide are employed to determine the point at which an opalescence of equal intensity is produced in the clear supernatant liquid. Finally a slight excess of silver nitrate is added, and the precipitate collected in a Gooch's crucible and weighed. The mean of three experiments gave Zn = 65·402 from the ratio $ZnBr_2 : 2Ag$, and the mean of three other experiments gave Zn = 65·406 from the ratio $ZnBr_2 : 2AgBr$.

The author concludes that when O = 16 the most probable value for the atomic weight of zinc is 65·40. E. C. R.

Electrolytic Preparation of Zinc and Lead. By Richard Lorenz (*Zeit. anorg. Chem.*, 1895, **10**, 78—116).—*Electrolysis of Fused Zinc Chloride.*—The chief difficulty to be overcome in the electrolysis of zinc chloride, is to obtain the salt entirely free from water. The zinc chloride, which still contains water, is placed in a V-tube of combustion glass, and heated to quiet fusion. A carbon electrode is placed in each arm of the tube. Directly the current is started, a brisk evolution of gas, due to the presence of water, takes place at both electrodes; the gas evolved at the positive electrode is at the commencement hydrogen chloride, but after some time chlorine is evolved;

meanwhile the evolution of gas at the negative electrode diminishes, and zinc begins to be deposited. During the deposition of the first few drops of metal, a brisk evolution of hydrogen takes place at the negative electrode. As the zinc which is deposited at first is not pure, but contains lead and other metals which may be present, the molten electrolyte is poured off into a similar V-tube as soon as the less positive metals have been deposited, and the electrolysis is continued; pure zinc is then deposited. The electrolyte, which now consists of pure zinc chloride, is a clear, limpid, highly refractive liquid, under which the molten zinc appears like mercury. It solidifies, on cooling, to a white, porcelain-like mass, and is the most hygroscopic substance the author has worked with.

Fused lead chloride is easily electrolysed in a similar way.

Fused cadmium chloride is not so easily electrolysed; chlorine is at once evolved at the anode, and at the cathode brownish-black clouds which dissolve in the electrolyte, whilst a small quantity of cadmium is deposited. The electrolyte contains a lower chloride of cadmium, which can be obtained as a crystalline metallic powder by lixiviating the electrolyte with water; this compound is difficult to dissolve in hydrochloric acid, and the solution does not at first give a precipitate with hydrogen sulphide, but, after some time, a yellow precipitate is suddenly deposited.

In the electrolysis of fused silver chloride, the silver is deposited as a brown mass, and when a small quantity of melted zinc or lead is placed in contact with the cathode, the silver dissolves in the molten metal. Silver chloride dissolves in zinc and lead chlorides, and, on subjecting the mixture to electrolysis, the silver is deposited first. The silver is also deposited when a zinc rod is placed in molten zinc chloride containing silver chloride.

Copper chloride, dissolved in zinc chloride, in which, however, it is only slightly soluble, can be electrolysed by employing a cathode of molten zinc, when all the copper is obtained as a zinc copper alloy.

Mixtures of zinc, silver, lead, copper, and cadmium chlorides on fusion give colourless electrolytes, which are easily manipulated. The addition of lead chloride to zinc chloride greatly increases the ease with which the fused salt is dehydrated by heat alone, and magnesium and calcium chloride produce the same effect. When such mixtures of fused metallic chlorides are electrolysed, the metals are deposited one after the other, and can be obtained pure by fractional electrolysis.

With a mixture of lead and zinc chlorides containing cadmium chloride, after 20 ampère-minutes, the metallic regulus contained 97·34 per cent. lead, 1·35 per cent cadmium, and 1·30 per cent. zinc; after 175 ampère-minutes, it contained 1·30 per cent. lead, 2·55 per cent. cadmium, and 96·15 per cent. zinc, and after 335 ampère-minutes, pure zinc was deposited. With a mixture of lead, silver, and zinc chlorides, a separation of the silver and lead cannot be obtained; after 2·5 ampère-minutes, the regulus contained 60·6 per cent. silver, 8 per cent. lead, and 7·5 per cent. zinc; after 7·5 ampère-minutes, 80 per cent., 5 per cent., and 14 per cent. respectively, and after 27·5 ampère-minutes, 0·49 per cent., 96·96 per cent., and 2·5 per cent.; after 172·5 ampère-minutes, pure zinc was obtained. With a mixture of zinc and silver chlorides, and employing a cathode of molten lead, the silver was easily separated; with a cathode of molten zinc, however, after 330 ampère-minutes, the electrolyte still contained traces of silver. With a mixture of copper and zinc chlorides, and employing a cathode of molten zinc, copper is deposited at once, before the current is started, and after 90 ampère-minutes pure zinc is obtained.

A large number of experiments, fully described in the original paper, show that 0·9 volt is sufficient to deposit zinc by this method, and a slightly lower voltage to deposit lead. The deposition of zinc is theoretical, 435·89 ampère-minutes deposited 9 grams, whereas, theoretically, 8·86 grams should have been deposited.

The author bases a method of winning zinc and lead from their ores on the results of the above experiments. Ores containing chiefly zinc, with lead and small quantities of silver and cadmium, are roasted and treated with hydrochloric acid. When excess of acid is employed, the iron and aluminium are precipitated from the solution by the addition of zinc oxide, and the purified liquor evaporated and the residue fused. Ores which contain chiefly lead are treated with dilute acetic acid, and the lead and silver precipitated from the solution by the addition of sufficient hydrochloric acid. After separation of the lead and silver chlorides, the liquor is again used to lixiviate fresh portions of ore until it becomes saturated with zinc acetate. The acetic acid is then removed by treating the liquor with hydrogen chloride and distilling, and again used with fresh portions of the ore. A description of an apparatus suitable for carrying out the operation on a technical scale is given. The chlorine evolved during the electrolysis is converted into hydrochloric acid by the method described by the author (this vol., ii, **17**). E. C. R.

Chromates and Dichromates of the Heavy Metals. By JUL. SCHULZE (*Zeit. anorg. Chem.*, 1895, **10**, 148—154).—In contradiction of the results obtained by Krüss and Unger (Abstr., 1895, ii, 355), the author has obtained the following chromates and dichromates in a crystalline form.

Copper dichromate, $CuCr_2O_7 + 2H_2O$, is obtained by saturating a cold solution of chromic acid, previously freed from sulphuric acid, with copper carbonate, and evaporating the greenish-brown solution under the air pump. It separates in very lustrous, black crystals, is slightly hygroscopic, and dissolves easily, and without decomposition, in cold water; when heated with water, however, it decomposes, and is partially converted into a brown compound. It is identical with the salt described by Dröge (*Annalen*, **101**, 39).

Copper chromate is obtained by heating the dichromate with copper oxide in a sealed tube at 220°. It crystallises in minute, brownish, transparent prisms, insoluble in water, but easily soluble in acids or in chromic acid; when boiled with water, it gradually decomposes, and yields the dichromate and the salt $3CuO,CrO_3 + 2H_2O$.

Cadmium dichromate, $CdCr_2O_7 + H_2O$, obtained in the same way as the copper salt, separates in orange-brown, cubic crystals, and dissolves easily, and without decomposition, in water.

Cadmium chromate, obtained by heating the dichromate with cadmium hydroxide, in a sealed tube, at 200°, separates as a bright, orange-yellow powder, which appears crystalline under the microscope. When boiled with water, it yields the dichromate and a brownish-yellow powder. The filtrate obtained in the preparation of the chromate, when allowed to remain for some time, deposited crystals containing $2H_2O$, and this is the only chromate of the heavy metals which contains water of crystallisation.

Zinc dichromate, $ZnCr_2O_7 + 3H_2O$, crystallises in dark, reddish-brown, crystalline crusts, and has similar properties to the above salts. *Zinc chromate* is obtained as a fine powder, which appears crystalline under the microscope; it is insoluble in water, easily soluble in acids, and is decomposed by boiling with water, yielding the dichromate and a greyish-yellow, crystalline basic chromate.

Manganese carbonate dissolves in a cold solution of chromic acid in the proportion of 1 to 2, but the product obtained on evaporation was not crystalline. It formed a black powder containing chromic oxide. Cobalt and nickel oxides also dissolve easily in a cold solution of chromic acid in the ratio of 1 to 2.

The author has attempted to prepare a chromic acid alum by adding potassium chromate to a solution of alumina in chromic acid, but in all cases potassium dichromate was formed. E. C. R.

Carbides of the Metals of the Rare Earths. By OTTO PETTERSSON (*Ber.*, 1895, **28**, 2419—2422).—When the oxides of yttrium and lanthanum are mixed with powdered carbon and reduced in a carbon crucible in the electric arc, carbides of the formula MC_2 are produced. The end of the reduction is rendered evident by the appearance of flames, arising from the vapour of the metal, which show a very brilliant spectrum, in which the most conspicuous lines are reversed. The carbides are crystalline and brittle, and have a golden yellow colour when freshly broken, but the surface is almost as rapidly attacked by the moisture of the air as a fresh surface of metallic sodium, a thin grey layer of oxide being formed. They are decomposed by water with evolution of hydrogen and carburetted hydrogen, the hydroxide of the metal and graphitic carbon being deposited. *Yttrium carbide* has the sp. gr. 4·185, whilst that of *lanthanum carbide* is 4·718; both of these carbides contain 2—3 per cent. of graphitic carbon, which has not been included in the composition on which the formula is based. Drawings are given of the simple electric furnace employed. A. H.

Crystallised Anhydrous Manganese Sulphide. By A. MOURLOT (*Compt. rend.*, 1895, **121**, 202—203).—When well dried, amorphous manganese sulphide, mixed with a small quantity of sulphur, is subjected to the action of an arc from a current of 40 ampères and 20 volts for about 20 minutes, the upper part of the fused mass, after cooling, is distinctly crystalline. With more powerful currents, the sulphide does not crystallise so well. The action of carbon bisulphide and hydrogen sulphide at a high temperature on manganese prepared in the electrical furnace yields the amorphous sulphide only.

The crystallised sulphide is in the form of small, transparent, deep green octahedra, which have no action on polarised light; sp. gr. = 3·92, hardness = 3·5 to 4. The fused sulphide is sufficiently hard to scratch quartz; sp. gr. = 4·06. The crystallised sulphide, prepared in the manner indicated, is identical in composition and physical properties with *alabandine;* it has practically the same chemical properties as the amorphous sulphide, but is less readily attacked by reagents. Fluorine has no action on it in the cold, but attacks it below a red heat with incandescence and the production of white fumes. Hydrogen is without action on the sulphide at 1200°, and carbon does not reduce it under the influence of an arc from a current of 1000 ampères and 50 volts. C. H. B.

Compounds of Ferrous Chloride and Nitric Oxide. By V. Thomas (*Compt. rend.*, 1895, **121**, 204—206).—The three compounds of ferrous chloride and nitric oxide (Abstr., 1895, ii, 271) have no appreciable tension of dissociation at the ordinary temperature either in a vacuum or in a current of a carefully dried, inert gas. Water dissolves the compound, $Fe_2Cl_4,2NO$, without any evolution of gas, and no gas is evolved if the other two compounds are added to a large proportion of water; but if water is allowed to drop on the solid compounds, gas is liberated in large quantity. Potassium hydroxide or ammonia behaves similarly with all three compounds, and produces a greyish-white precipitate which rapidly becomes bluish-green and, finally, black. There is no liberation of gas, and the liquid contains neither a nitrate nor a nitrite, nor ammonia; the solutions obtained by Gay's methods (Abstr., 1885, 1109), on the other hand, evolve large quantities of a mixture of nitrous oxide and nitrogen. When the black precipitate, produced by alkalis in solutions of the solid compounds, is placed in a vacuum, it gives off a considerable quantity of almost pure nitrogen. If a solution of the compound $Fe_2Cl_4,2NO$ is precipitated with silver nitrate, there seem to be indications of the formation of silver hyponitrite; but this supposition could not be confirmed, and the phenomena are not shown by the other two compounds. Nitric oxide is only very slowly absorbed by solutions of the compounds Fe_2Cl_4,NO and $5Fe_2Cl_4,NO$, and seems to act as an oxidising agent. C. H. B.

Ammonia and the Chlorides of Iron. By Alfred S. Miller (*Amer. Chem. J.*, 1895, **17**, 570—571).—Anhydrous ferric chloride will absorb 6 mols. of ammonia, forming the compound $FeCl_3,6NH_3$ at ordinary temperatures; five mol. are retained in a perfectly dry atmosphere at the ordinary temperature, but at 100° the compound becomes $FeCl_3,4NH_3$. The ammonia compound is not deliquescent, and is insoluble in water, but loses ammonia and chlorine when washed; it dissolves in mineral acids, yielding red solutions. The compound showed a gradual dissociation (*sic*) with formation of ammonium chloride, from 100° to 280°; just below 280°, it was entirely dissociated. The compound absorbs dry chlorine with a considerable development of heat.

Ferrous chloride absorbs approximately 6 mols. of ammonia at the ordinary temperature, forming a white powder, $FeCl_2,6NH_3$, which readily oxidises in air. When heated at 100° in hydrogen, the compound became $FeCl_2,2NH_3$. A. G. B.

Chromium Sulphate. By Albert Recoura (*Ann. Chim. Phys.*, 1895, [7], **4**, 494—527).—This paper is mainly a *résumé* of work previously published elsewhere (compare Abstr., 1891, 1430; 1892, 411 and 783; 1893, ii, 470 and 528; 1894, ii, 382).

It is shown that when a solution of the violet chromium sulphate is heated for some time at 100°, it becomes green, and that the solution then contains free sulphuric acid and a basic salt formed according to the equation $2Cr_2(SO_4)_3 + H_2O = Cr_4O(SO_4)_5 + H_2SO_4$. The salt thus formed is the sulphate of a radicle $[Cr_4O(SO_4)_4](OH)_2$, which the author terms *sulphochromyl hydroxide.* The violet sulphate, $Cr_2(SO_4)_3 + 18H_2O$, when heated to 90° loses water, and gives the compound $Cr_2S_3O_{12} + 8H_2O$, which is neither a sulphate nor yet a chromium salt. The same compound may be obtained from a solution of the violet salt; it is characterised by the ease with which it unites with 1, 2, or 3 mols of sulphuric acid or of a metallic sulphate, thus giving rise to the chromosulphuric acids and the chromosulphates. Under special conditions, this compound can also unite with 5 or 6 mols. of sulphuric acid, yielding compounds with quite distinct constitutions and properties. The latter compounds are much less stable than the chromosulphuric acids; they lose sulphuric acid at 140°, and yield sulphochromic hydroxide,

$$[Cr_2O_2(SO_3)_4](OH)_2.$$

This is an acid of chromium which is characterised by the insolubility of all its salts. J. J. S.

Molybdenum Dihydroxychloride. By Ad. Vandenberghe (*Zeit. anorg. Chem.*, 1895, **10**, 47—59).—The author has determined the molecular weight of molybdenum dihydroxychloride by means of the boiling point and freezing point methods with the object of determining its constitution. The compound is prepared by heating molybdic anhydride at 200° in a current of dry hydrogen chloride; it sublimes in lustrous, white crystals, and, when slowly cooled, in beautiful, bright yellow needles, and is very hygroscopic.

The determination of the molecular weight by means of the boiling point method was performed in a modification of Beckmann's apparatus, and the molecular weight calculated from the formula $M = Kp/lt$. With ether and acetone as solvents, the numbers obtained agree with the theoretical value, 217, assuming that the compound is an atomic compound of the constitution $MoO(OH)_2Cl_2$, that is, the action of hydrogen chloride on molybdic anhydride is analogous to its action on sulphuric anhydride. With methylic and ethylic alcohols as solvents, a smaller molecular weight was obtained corresponding with that required if the compound is dissociated into its ions, Cl and MoO_3H_2Cl.

The determination of the molecular weight by the freezing point method, using anhydrous acetic acid, gave results agreeing with the numbers obtained with methylic alcohol by the boiling point method; with water as the solvent, however, numbers were obtained closely approaching 54·2, which is the number required, assuming that the compound is dissociated into the ions Cl, Cl, H and $O{:}Mo{\cdot}OH{\cdot}O$.

The author has attempted, without success, to determine the vapour density of the compound; it is already dissociated at 158° and 181°. E. C. R.

Molybdenum Bronzes. By ALFRED STAVENHAGEN and E. ENGELS (*Ber.*, 1895, **28**, 2280—2281).—When acid sodium molybdate, $Na_6Mo_7O_{24}$, is fused and submitted to electrolysis, a substance is formed which crystallises in quadratic prisms of a deep blue colour. It is insoluble in hydrochloric acid, but dissolves in aqua regia and in alkalis. The substance contains 6 per cent. of sodium and 62·7 per cent. of molybdenum, and is looked on by the authors as a sodium molybdenum bronze. A. H.

Preparation of Tin Tetrachloride in large Quantities. By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1895, 44—46).—Tin tetrachloride is most easily prepared by the action of chlorine on tin at the ordinary temperature. The most suitable apparatus is a tube closed at one end, 5 to 6 cm. wide, and 75 to 100 cm. long, fitted with a condenser and a tube, by means of which dry chlorine can be passed to the bottom of the tube, where it bubbles through a little tin tetrachloride. The tube is filled nearly to the top with granulated tin. 1½ to 2 kilos. of the tetrachloride are easily prepared in about one hour. The product is pure, and boils at 114°. E. C. R.

Chemistry of the Cyanide Process for the Extraction of Gold from its Ores. By GEORGE A. GOYDER (*Chem. News*, 1895, **72**, 80—82, 95—97).—The amount of simple cyanide in a solution containing certain double cyanides, such as the zinc potassium cyanide in the final solution of the cyanide process, cannot be accurately estimated by titration with standard silver nitrate in the presence of a little potassium iodide, because the final reaction is indistinct, and, moreover, an amount of silver nitrate is used up by these double cyanides, which increases continuously with the temperature, with the amount of fresh simple cyanide added, and with the dilution. The author has observed that hydrocyanic acid does not decolorise phenolphthaleïn, that potassium cyanide is alkaline to it, and that the double cyanides are neutral, and on this has based the following method of testing the final liquors for simple cyanide, which, however, is not applicable in the presence of caustic alkalis or alkali carbonates; alkali hydrogen carbonates do not interfere. 100 c.c. of the solution is titrated with decinormal hydrochloric acid, using 1 c.c. of 0·05 per cent. solution of phenolphthaleïn as indicator, 1 c.c. of acid = 0·0065 per cent. of potassium cyanide. The estimation of all the cyanides, except the iron, mercury, or copper potassium cyanides, may be effected by the silver method if the solution be mixed with half its volume of 5 per cent. caustic soda, filtered, and about 15 c.c. of the filtrate taken for titration.

The following are the numbers per cent. obtained from the analysis of the final solution from the treatment of the Mount Torrens ore by the cyanide process. Cu 0·0030, Zn 0·0178, Fe 0·0061, Ca 0·0145, Mg 0·0042, K 0·0609, Na 0·0645, Cl 0·0875, CN 0·0477, SO_3 0·0401, CO_2 0·0333, and traces of Co, Hg, Ag, and Au. Numbers, too, are given showing how the progress of the extraction may be followed by observing the strength of the outflowing solution.

Data are also furnished showing that without further comminution little or no gold can be extracted by potassium cyanide from the tailings. Furthermore, it is shown that hydrocyanic acid in the presence of air, and the double cyanides of zinc and potassium and of copper and potassium exert a solvent action on gold, but that the corresponding mercury salt does not. Allowing one lot of cyanide solution to drain away from the ore undergoing extraction before adding a fresh lot was found to be destructive to the cyanide without commensurate benefit. The destructiveness of ferrous and other soluble metallic salts is commented on. D. A. L.

Mineralogical Chemistry.

The Crystalline Form of chemically simple Substances. By Friedrich Rinne (*Zeit. physikal. Chem.*, 1895, **16**, 529—545).—Retgers has pointed out that most elements and diatomic compounds, as well as many triatomic compounds, crystallise either in the regular or in the hexagonal system (Abstr., 1894, ii, 348); he has, however, failed to recognise any further relation between this chemical simplicity and the crystalline form. The author finds, however, that such substances belonging to the hexagonal system fall into three groups, each characterised by similarity of crystal angles and habit. (1) The magnesium type with $a : c$ about 1 : 1·6, and of hexagonal symmetry; this group includes zinc oxide, ice, tridymite (SiO_2), greenockite (CdS), niccolite (NiAs), lead iodide, &c. (2) The arsenic type with $a : c$ about 1 : 1·3, and of rhombohedral symmetry; this includes bismuth, sulphur, tellurium, zinc, graphite, millerite (NiS), &c. (3) The quartz type with $a : c$ about 1 : 1·1, and also of rhombohedral symmetry; cinnabar falling in this group. Of elements and simple compounds belonging to the tetragonal system, an α-tin type and a rutile type are distinguished on the same lines. Some less simple compounds and also some pseudo-hexagonal substances can be referred to these types. Retgers's criticism of the author's views (*Zeit. physikal. Chem.*, **14**, 522) are discussed. L. J. S.

Silver Minerals of the Australian Broken Hill Consols Mine. By George Smith (*Journ. and Proc. Roy. Soc., N.S.W.*, 1893, **27**, 368—375).—This mine, which is very rich in silver minerals, is where the new mineral willyamite (this vol., ii, 31) was found.

Dyscrasite occurs in large masses, sometimes weighing 23 cwt. and containing 80—83 per cent. of silver; the more common proportions of silver and antimony in this ore are Ag_3Sb, Ag_4Sb, Ag_6Sb, $Ag_{12}Sb$.

Argentite is rare; a typical impure specimen gave 78 per cent. of silver.

Stephanite occurs only in small quantity, a specimen of sp. gr. 6·23 gave 67·1 per cent. of silver.

Pyrargyrite, amorphous, gave 56·3 per cent. of silver.

Sternbergite occurs with dyscrasite and pyrargyrite, it is of a bronze colour, with a blue tarnish; sp. gr. 4·34; it gave 33·94 Ag, 30·76 Fe, and a little antimony.

Stromeyerite is the principal ore of this mine; it is never crystalline; contains about 30 per cent. of silver, and often a little antimony.

Argentiferous tetrahedrite is also an abundant ore, it usually contains about 20 per cent. of silver; the richer ore (in silver) is lighter in colour and brighter in lustre than the poorer.

Brongniardite is very rare, it occurs with stromeyerite; the purest is crypto-crystalline and resembles argentite; it is encrusted with grey lead carbonate, into which it has been altered; it contains 34½ per cent. of silver.

Antimonial silver chloride; pure silver chloride and bromide are comparatively rare in this mine, the larger masses are always antimonial, of a grey colour and with about 35 per cent. of silver. Some of the masses enclose veins of the ordinary chloride, and patches of dyscrasite, from the latter of which the mineral has probably been derived.

Bournonite is massive and impure, with 5 to 7 per cent. of silver, due to admixture of argentiferous tetrahedrite. A sample of the ore gave

Pb.	Cu.	Sb.	Fe.	Ag.	S.	Insol.	Moisture [by diff.].
29·0	8·9	25·0	3·0	5·7	22·5	3·0	[2·9]

Chlorargyrite gave 73·1 per cent. of silver.

Iodyrite is fairly plentiful, always occurring in limonite.

Galena contains varying amounts of silver, and has 65 to 83 per cent. of lead; it is often altered to anglesite, this being afterwards altered to cerussite. Also Johnstonite?

Cerussite contains about 60 per cent. of lead; silver is also present.

The vein stuff of the mine is calcite and siderite, which in the upper parts is replaced by limonite. Copper ores only occur in small quantity. About 50 minerals are mentioned or shortly described, amongst them being vanadinite, volgerite, and native sulphur.

L. J. S.

Lorandite, a new Thallium Mineral. By József A. Krenner (*Math. és Természett. Ertesitö*, 1894, **12**, 471, and *Ber. aus Ung.*, 1895; **12**, 262).—This new and rare mineral occurs as tabular or short prismatic, mono-symmetric crystals on realgar at Allchar, Macedonia; the colour is cochineal- to kermesite-red, and the crystals are transparent, and can be bent like selenite. Analysis gave

S.	As (calc. from loss).	Tl.
19·02	(21·47)	59·51

This agrees with the formula $TlAsS_2$. L. J. S.

Composition of Kermesite. By Henri Baubigny (*Compt. rend.*, 1894, **119**, 737—740).—Partial analysis gave Sb 75·13, S 20·04 per cent. This agrees with the formula Sb_2OS_2, or $2Sb_2S_3,Sb_2O_3$, which was deduced from the early analysis of H. Rose, the only one that has been previously made of the mineral. Tartaric acid solution had practically no action on the mineral. L. J. S.

Willyamite, a New Mineral from Broken Hill, N.S.W.—By Edward F. Pittman (*Zeit. Kryst. Min.*, 1895, **25**, 291; from *Journ. and Proc. Roy. Soc., N.S.W.*, 1893, **27**, 366—368).—This new mineral was found with dyscrasite in a calcite and siderite vein. The crystal system is regular, and there is a perfect cubic cleavage; fracture uneven. Colour between tin-white and steel-grey; lustre metallic; streak greyish-black. $H = 5\frac{1}{2}$; sp. gr. 6·87. Analysis by J. C. H. Mingaye, gave

	Sb.	Co.	Ni.	S.	Total.
I.	56·85	13·92	13·38	15·64	99·79
II.	56·71	13·84	13·44	15·92	99·91

There are also traces of iron, copper, and lead. The formula is $CoS_2,NiS_2,CoSb_2,NiSb_2$, which corresponds with ullmannite in which half the nickel is replaced by cobalt. L. J. S.

Calaverite from Cripple Creek, Colorado. By William F. Hillebrand (*Amer. J. Sci.*, 1895, [3], **50**, 128—131).—Tellurium has been previously known to occur in the ores of this district, partly in combination with gold as gold-tellurium (sylvanite). Analyses of the present mineral were made on material from three mines, namely, Prince Albert mine, I; Raven mine, II; and C.O.D. mine, III.

	Te.	Au.	Ag.	Insol.	Fe_2O_3.	Fe.	S.	Total.
I.	57·27	38·95	3·21	0·33	0·12	—	—	99·88
II.	47·69	33·93	1·47	5·80	—	5·41	6·17	100·47
III.	53·89	39·31	0·85	0·91	—	1·67	1·58	—

In III also Mn, 0·23; Ca, 0·51; Mg, 0·10; O, F, and soluble silica by difference, 0·95. These analyses, after deducting gangue, reduce to the formula $(Au,Ag)Te_2$; the amount of silver, in analysis I, agrees with that in Genth's analyses, but is less in II and III. The mineral is of a pale bronze-yellow colour, the powder being greenish-grey; sp. gr. 9·00. The imperfect and deeply striated crystals of prismatic habit seem, according to Penfield, to be asymmetric, but with angles and axial ratios near to sylvanite. L. J. S.

Nantokite from New South Wales. By Archibald Liversidge (*Min. Mag.*, 1894, **10**, 326—327).—This mineral was found associated with cuprite, native copper, cerussite and quartz, at the Broken Hill South mine; when freshly fractured, it is colourless and transparent with a highly vitreous lustre. On exposure, the mineral soon effloresces and becomes green. Analysis, by J. O. Armstrong and A. D. Carmichael, gave

Cu.	Cl.	Total.	Sp. gr.
64·28	35·82	100·10	4·1

The mineral is soluble in ammonia, hydrochloric acid, and in a solution of sodium chloride; when heated with water, cuprous oxide is deposited, and some copper goes into solution as cupric chloride.

L. J. S.

Artificial Percylite. By Charles Friedel (*Bull. Soc. fran. Min.*, 1892, **15**, 96—101).—By the prolonged action of copper chloride solution on lead hydroxide, a blue, crystalline powder was formed; this consists of strongly birefringent tetragonal octahedra, having the characters of the tetragonal variety of boleite (Abstr., 1892, i, 123), and also, in much smaller quantity, of cubic crystals corresponding with the cubic variety of boleite. Analysis of the material agreed with the formula PbCl·OH,CuCl·OH, and the name percylite is here given (apparently to both kinds of crystals), to distinguish it from the silver-holding boleite. [The first kind of crystals have since been named *cumengeite* by Mallard, Abstr., 1895, ii, 115, and 1893, ii, 417]. Phosgenite was also formed by the above reaction.

L. J. S.

Artificial Boleite. By Charles Friedel (*Bull. Soc. fran. Min.*, 1894, **17**, 6—8).—A mixture of lead and silver hydroxides, in the proportion they exist in boleite, with some clay, was acted on by copper chloride solution for several months; the action was much slower than when cumengeite was formed (preceding Abstr.). In the clay were found blue cubic crystals which were built up exactly like certain crystals of boleite; having an isotropic cubic nucleus, surrounded by six truncated tetragonal pyramids. The crystals were too small in quantity and too impure for analysis, but they certainly differ from those formed without the intervention of silver.

L. J. S.

Boleite from New South Wales. By Archibald Liversidge (*Journ. and Proc. Roy. Soc. N.S.W.*, 1894, **28**, 94—96).—This mineral occurs at the Broken Hill South mine with hæmatite and quartz; it is of an indigo-blue colour with a strong vitreous lustre, and is found as cubes with a nearly perfect cubic cleavage. Analysis by Carmichael and Armstrong gave

Ag.	Pb.	Cu.	Cl.	O (calc.).	H_2O (calc.).	Total.	Sp. gr.
8·25	47·20	19·20	13·50	[6·10]	[5·44]	99·69	5·02

This agrees closely with the analysis of Mallard and Cumenge (Abstr., 1892, i, 123). Liversidge determines the water directly as 6·39 per cent.; this may be a little too high.

L. J. S.

Rubies of Burma. By C. Barrington Brown and John W. Judd (*Proc. Roy. Soc.*, 1895, **57**, 387—394).—The famous ruby district of Upper Burma is situated 90 miles N.N.E. of Mandalay, the principal mining centre being Mogok. The gneissic rocks of the district are of intermediate chemical composition, including biotite-gneiss, biotite-granulite and rarely biotite-schist; interfoliated with these are more acid rocks, such as pegmatites, quartzites &c., also more basic rocks, such as pyroxene-gneiss &c., these passing into ultra-basic pyroxenites, and thirdly bands of crystalline limestone. In the acid rocks, tourmaline occurs, as in the adjacent rubellite district of Nyoungouk; the basic rocks are rich in garnet, and in the limestone corundum and spinel of various colours occur. The limestones are more closely associated with the basic and ultra-basic rocks, which contain crystals of calcite, and, as the amount of calcite increases, they graduate into the limestones; it being supposed that the limestones have been derived by the alteration of the basic felspars (anorthite) of the basic rocks. The hydrated aluminium silicates, liberated by the same alteration, having in the first place given rise to hydrated aluminium oxides, which are afterwards converted into anhydrous alumina. In the limestones are also found numerous other minerals, such as phlogopite, graphite, pyrrhotite, felspars (moonstone), amphiboles, pyroxenes, lapis lazuli &c.

The subsequent alteration of the rubies is seen as an inner zone of diaspore passing outwards into various hydrous aluminium silicates—margarite, vermiculite, mica, kaolinite &c.; these changes taking place along the primary and secondary solution planes, or planes of chemical weakness, of corundum (Judd, *Min. Mag.*, 1895, **11**, 49).

L. J. S.

Cerussite coated with Galena; Manganite and Chloritoid from Michigan; Apatite and Hessonite in Pegmatite. By William H. Hobbs (*Amer. J. Sci.*, 1895, [3], **50**, 121—128).—*Cerussite* in twinned, prismatic crystals, from near Missoula, Montana, was partially coated with an extremely thin, bright film having a metallic lustre. Analysis gave

PbO.	CO_2.	$\underbrace{Fe_2O_3,Al_2O_3}$.	SiO_2.	S.	Total.
80·83	15·51	0·55	2·15	trace	99·04

The trace of sulphur and excess of lead indicate that the film consists of galena. As this film is only found on the cerussite, and not on the accompanying minerals, it may be considered to be due to the alteration of the cerussite, probably by the action of hydrogen sulphide. From the parts of the crystals, so coated, good measurements of the angles were obtained.

Manganite, from Lucy Mine, Negaunee, Michigan, gave on analysis

Mn.	H_2O.	$BaCO_3,CaCO_3$.	$MgCO_3$.	O (calc.).	Total.
60·29	10·10	0·58	2·98	26·35	100·30

The crystals are simple in form, but the habit varies slightly according as they are associated with barytes or not. The barytes is described.

Chloritoid, as large porphyritic crystals, occurs in blocks of phyllitic schist on the south shore of Michigamme Lake, Michigan; in the rock also occur colourless mica, biotite, tourmaline, magnetite, and some small blades of chloritoid. The chloritoid crystals, sometimes 6 cm. or more across, are hexagonal in outline and tabular parallel to the base, and are frequently twinned. The analysis, which was made on a crystal enclosing magnetite, this being surrounded by a zone of quartz, is nearly the same as that of the masonite of Natic, Rhode Island.

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	H_2O.	P_2O_5.	Total.
35·52	29·53	5·85	22·38	0·76	1·38	5·94	trace	101·36

From the optical characters, the crystals seem to be mono-symmetric or asymmetric, with a close approach to the former.

Apatite and Hessonite occur in the pegmatite veins cutting the gneiss about Canaan, Conn., along with other crystallised minerals, such as white felspar and muscovite in large crystals, biotite and tourmaline. The cinnamon-coloured garnet is sometimes intergrown with felspar, producing a structure resembling graphic granite. The apatite is green in colour. L. J. S.

Analysis of Monazite. By ALBERT THORPE (*Chem. News*, 1895, **72**, 32).—Analysis of monazite from North Carolina gave

P_2O_5.	La_2O_3.	Ce_2O_3.	ThO_2.	SnO_2.	MnO.	CaO.	Total.
28·43	23·62	25·98	18·01	1·62	1·33	0·91	99·90

L. J. S.

Evansite from Tasmania. By HENRY G. SMITH (*Journ. and Proc. Roy. Soc., N.S.W.*, 1893, **27**, 382—383).—This mineral occurs at Mount Zeehan, as small, globular excrescences, which are colourless and of a vitreous lustre, or milky white and slightly opalescent. Brittle; H = 4; sp. gr. 1·842. When heated, it decrepitates, and gives off water, which, in being alkaline (probably due to sodium), differs from the original evansite. Analysis gave

H_2O.	Al_2O_3.	P_2O_5.	Total.
41·266	40·186	18·114 (mean of 17·996 and 18·232)	99·566

This agrees with the usual formula $3Al_2O_3,P_2O_5,18H_2O$. The perfectly glassy beads contain neither fluorine, silicon, nor iron, but the white, opaque, cellular portions are very siliceous. L. J. S.

A Bed of Aluminium and Potassium Phosphates in Algeria. By ADOLPHE CARNOT (*Compt. rend.*, 1895, **121**, 151—155).—The floor of a stalactitic cavern near Oran, in Algeria, is covered with a deposit, from 1 to 3 metres thick, of a brownish-red phosphatic earth, with white and variegated veins and spongy masses. The cavern and the deposit contain no bones of vertebrata. The white matter consists chiefly of aluminium phosphate mixed with a variable proportion of silica, and sometimes of calcium phosphate; when red, it contains ferric oxide, and, when black, manganese oxide or cobalt oxide. The light, rounded, unctuous, agglomerated masses show no traces of crystalline structure, and are to a large extent soluble in dilute acids and in ammonium citrate solution. One specimen had the composition P_2O_5 35·17, Al_2O_3 18·18, K_2O 5·80, NH_3 0·48, CaO 0·31, SiO_2 11·60, loss at 100° 13·40, loss at 100—180° 10·55, loss at 180° to a red heat 4·35; MgO, F, Cl, SO_3, traces. Total = 99·84. If the aluminium phosphate is supposed to be the normal salt, the ratio of the remaining phosphoric acid to the other bases is intermediate between that of monometallic and bimetallic phosphates, and the aqueous solution of the phosphates is neutral to both methyl-orange and phenolphthaleïn. The phosphate does not belong to the same class as Gautier's *minervite* (Abstr., 1893, ii, 536, 577), and the author does not assign to it any definite formula. It is most probable, however, that the deposit has been formed by the infiltration of water containing ammonium phosphate, &c., derived from the oxidation of organic matter and phosphates of animal or vegetable origin, and also alumina derived from minerals (*loc. cit.*). C. H. B.

Retzian. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 54—59).—This new arsenate occurs as orthorhombic crystals in the cavities of the manganiferous limestone of the Moss mine, Nordmark, Sweden. It is of a chestnut- to chocolate-brown colour; lustre vitreous, approaching to greasy; subtranslucent. There is no cleavage. Pleochroism strong. Sp. gr. 4·15. The analysis is incomplete owing to lack of material; a constituent (amounting to 10·3 per cent.), separated from the manganese precipitate, not having been identified.

As_2O_5.	PbO.	FeO.	MnO.	CaO.	MgO.	SiO_2.	H_2O.	Insol.
24·4	0·2	1·7	30·2	19·2	2·7	0·5	8·4	4·3

The mineral is thus closely related to other hydrous manganese arsenates (allactite, synadelphite, diadelphite, hæmafibrite) from the same mine, and to flinkite from the Harstig mine, Sweden; none of these, however, contain any calcium, and some of them contain Mn_2O_3. L. J. S.

Artificial Gypsum. By ALEXANDRE GORGEU (*Bull. Soc. fran. Min.*, 1894, **17**, 8—9).—A flask containing calcium sulphite and filled with an aqueous solution of sulphurous acid was corked up; after several years a part of the sulphite was oxidised, and beneath the deposit at the bottom of the flask were thin crystals 1—3 cm. long. These at the attached ends were opaque owing to enclosed sulphite, but the transparent portions of the crystals contained no sulphurous acid, and on ignition lost 20·8 per cent. of water; they showed the usual cleavage, twinning &c. of gypsum. L. J. S.

Leadhillite Pseudomorphs in Missouri. By WARREN M. FOOTE (*Amer. J. Sci.*, 1895, [3], **50**, 99—100).—Leadhillite has recently been described from Granby, Mo., by Pirsson and Wells, (Abstr., 1894, ii, 458). The pseudomorphs with the form of scalenohedra of calcite consist often of cerussite, but sometimes of leadhillite, either as epimorphs or replacing the whole of the calcite. Pure white leadhillite also occurs in the form of cubes after galena; but in most cases the galena is represented by crusts and hollow forms of a grey amorphous material, this consisting of leadhillite containing some galena. Scattered through some crystals of leadhillite are to be seen the bright cleavages of galena. L. J. S.

Kauaiite, a new mineral from Hawaii. By EDWARD GOLDSMITH (*Proc. Acad. Nat. Sci., Philadelphia*, 1894, 105—107).—This volcanic product is white or faint cream coloured, and is dull and powdery closely resembling chalk in appearance. Under the microscope, it is seen to consist of granules all of about the same size, and it is pale blue by transmittent light; sp. gr. 2·566. When heated, it decrepitates slightly and becomes dark grey, giving off an oily substance and acid water; it becomes intensely incandescent before the blowpipe. It is soluble in acids only after ignition, but is dissolved by caustic alkali.

Eliminating about 5·94 per cent. of carbonaceous matter, the results of the analysis are

Al_2O_3.	K_2O.	Na_2O.	H_2O.	SO_3.
39·79	7·37	1·72	33·56	17·55

This gives the formula $2Al_2O_3,3(K,Na,H)_2O,SO_3$. This highly basic sulphate is distinguished from others in being insoluble in acids.

L. J. S.

Melanterite containing Zinc. By LÉOPOLD MICHEL (*Zeit. Kryst. Min.*, 1895, **25**, 316; from *Bull. Soc. fran. Min.*, 1893, **16**, 204).—Massive, pale green concretions of melanterite from Laurion, Greece, gave on analysis

SO_3.	FeO.	ZnO.	H_2O.	Total.
28·85	17·74	8·92	44·21	99·72

Formula $(Fe,Zn)SO_4,7H_2O$. Sp. gr. 1·95. L. J. S.

Artificial Powellite. By LÉOPOLD MICHEL (*Bull. Soc. fran. Min.*, 1894, **17**, 612—614).—On heating to a high temperature a mixture of six parts of sodium molybdate, one of sodium tungstate, three of calcium chloride and two of sodium chloride, translucent, milky-white crystals of powellite were formed; these have the form of tetragonal octahedra, and are about 2 mm. in diameter; they have an adamantine lustre and are optically positive. Analysis gave

MoO_3.	WO_3.	Ca.	Total.	Sp. gr.
62·37	10·23	26·41	99·01	4·61

L. J. S.

Pimelite and Asbeferrite. By EDWARD GOLDSMITH (*Zeit. Kryst. Min.*, 1895, **25**, 281; from *Proc. Acad. Nat. Sci., Philadelphia*, 1893, 174—175).—*Pimelite* occurs as a soft, greasy, very finely micaceous mineral of apple-green colour at Radnor, Delaware Co., Penn.; sp. gr. 2·596; given as probably mono-symmetric. It is decomposed by boiling hydrochloric acid, leaving 31·1 per cent. of insoluble sandy material. The soluble part, which is supposed to be pimelite, gave analysis I, from which the formula $(Mg,Ni,H_2)O,SiO_2$ is derived.

	SiO_2.	MgO.	NiO.	H_2O.	Fe_2O_3.	CaO.	Mn.
I.	45·93	34·44	7·69	11·68	—	—	—
II.	48·45	6·23	—	—	33·90	11·80	trace

Asbeferrite occurs as a secondary product, mixed with pyrites and on calcite, at the iron mine near the Falls of French Creek, Chester Co., Penn.; it is of a greyish-green colour, and consists of fine fibres matted together. Analysis II differs considerably from Igelström's analysis of asbeferrite. On heating, the mineral becomes a rusty colour. L. J. S.

Felspar of the Acmite-trachyte of the Crazy Mountains, Montana. By T. E. Wolff and Ralph S. Tarr (*Zeit. Kryst. Min.*, 1895, **25**, 281; from *Bull. Mus. Comp. Zool., Harvard Coll.*, 1893, **16**, No. 12).—The acmite-trachyte of this locality occurs as dykes, and contains felspar, ægirine, and sodalite in a ground mass of felspar, ægirine, and either nepheline or analcite. The optical extinction angles and the composition of the large felspar crystals point to soda-microcline or anorthoclase; analysis gave

SiO_2.	Al_2O_3.	CaO.	SrO.	BaO.	K_2O.	Na_2O.	Loss (H_2O).	Total.
62·31	22·63	0·63	0·57	0·77	4·79	7·68	0·72	100·10

L. J. S.

Analyses of Sodalite from New Localities. By L. McI. Luquer and G. J. Volckening (*Amer. J. Sci.*, 1895, [3], **49**, 465—466).—Under I is given the analysis of massive, cobalt-blue sodalite from the Laurentian system at Hastings Co., Ontario, Canada; the mineral shows a very distinct cleavage, and in thin section there are a few cloudy patches due to decomposition. A similar specimen from the Urals gave analysis II; in thin section a very perfect cleavage is seen, with commencing decomposition along the cleavage cracks. Another similar specimen from Congo State, Africa (III), showed in section only an imperfect cleavage and some decomposition; it is associated with limonite and decomposed felspar, and is the only known African occurrence of the mineral.

	SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	Cl.	Total.	O = Cl.	Sp.gr.
I.	37·34	31·25	0·38	25·01	0·74	6 79	101·51	1·53	2·303
II.	37·28	31·60	0·46	24·74	0·93	6·65	101·66	1·50	2·328
III.	37·85	30·87	0·51	25·43	0·22	6·46	101·34	1·46	2·363

L. J. S.

Constitution of the Lithia Micas. By Frank W. Clarke (*J. Amer. Chem. Soc.*, 1893, **15**, 245—250).—The micas have been considered by Clarke to be derivatives of the normal aluminium orthosilicate, $Al_4(SiO_4)_3$ (Abstr., 1890, 460); in the lithia micas, however, there is an oxygen ratio lower than that of the orthosilicate, and they are further characterised by the presence of fluorine. The lower oxygen ratio is explained by the partial replacement of SiO_4 by Si_3O_8, and the fluorine, which was previously explained by the presence of the group AlF_2 among the components of R′, is now explained by assuming that the clintonite type, $R''{<}\substack{O\\O}{>}Al\cdot SiO_4R'_3$, is replaced by the molecule $AlF_2\cdot SiO_4R'_3$.

In polylithionite, SiO_4 is entirely replaced by Si_3O_8, and Lorenzen's analyses may be represented by $5(AlF_2,Si_3O_8Li_3) + Al(Si_3O_8)_3(Na_2K)_3$. All the variations in composition of the lepidolites proper may be explained by the supposition that these micas are mixtures of two typical molecules, namely, $AlF_2\cdot Si_3O_8R'_3$, where R′ is principally lithium, and a muscovite molecule, $Al_3(SiO_4)_3R'_3$, in which R'_3 may be K_2H or KH_2; some peculiarities are explained by a small admixture of the molecule $AlF_2\cdot Si_3O_8Al$. Cookeite, which appears to be the vermiculite of the lepidolite series, has the fluorine replaced by hydroxyl, and we have a mixture of the three molecules, $Al(OH)_2 \cdot SiO_4Li_3$, $Al(OH)_2 \cdot SiO_4H_3$, and $Al(OH)_2 \cdot SiO_4Al$.

In the iron-lithia micas, zinnwaldite and cryophyllite, the case is more complicated, as the iron may belong to the molecule $AlF_2 \cdot Si_3O_8Fe''R'$, or to the biotite molecule $Al_2(SiO_4)_3Fe''_2R'_2$. Some zinnwaldites may be represented by mixtures of $AlF_2 \cdot Si_3O_8FeLi$ and $Al_3(SiO_4)_3K_3$, whilst cryophyllite is most easily represented by $Al_3X_3KH_2 + 2(Al_2X_3Fe_2H_2) + 3(AlF_2 \cdot XK_3) + 4(AlF_2 \cdot XLi_3)$, in which X represents SiO_4 and Si_3O_8 in the ratio 1 : 3. L. J. S.

Garnet from California. By FRANK W. CLARKE (*Amer. J. Sci.*, 1895, [3], **50**, 76—77).—A water-worn pebble, found 40 miles south of Los Angeles, closely resembled jade in being highly polished, very compact, and of an apple-green colour; analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	Alkalis.	Ignition.	Total.
37·54	22·84	0·79	0·26	36·66	0·44	0·13	1·74	100·40

Also traces of TiO_2, P_2O_5 and CO_2; sp. gr. 3·485. Hydrochloric acid extracts about 16 per cent. of Al_2O_3, and about 20 per cent. of CaO. As a grossular garnet simulating jade, it is of interest. L. J. S.

Almandine Garnet from the Hawkesbury Sandstone, Sydney, N.S.W. By HENRY G. SMITH (*Journ. and Proc. Roy. Soc., N.S. W.*, 1894, **28**, 47—50).—"Precious Garnet" occurs as small, irregular, reddish particles in a conglomerate (probably derived from granite) in the Hawkesbury sandstone. The colour is light, but sometimes deep red or purple; the mineral is isotropic, and shows a distinct cubical cleavage; sp. gr. 3·902. Analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	Mn.	Total.
38·704	21·795	2·168	27·750	9·725	trace	100·142

The sesquioxides are a little too high for the garnet formula.

L. J. S.

Analysis of Anorthite from Raymond, Maine. By WILLIAM H. MELVILLE (*Bull. U.S. Geol. Survey*, 1893, No. 113, 110).—White crystals associated with idocrase, cinnamon garnet, pyroxene, and scapolite; gave, on analysis,

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O (at 100°).	Loss on ignition.	Total.
43·13	30·95	1·04	19·71	0·31	1·29	0·69	0·22	2·80	100·14

Also traces of FeO, MnO and Li_2O. L. J. S.

Analysis of Prehnite from Fassa, Tyrol. By EDWARD A. SCHNEIDER (*Bull. U.S. Geol. Survey*, 1893, No. 113, 112).—This analysis was made in connection with the experiments noticed in the Abstract, 1892, 772.

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	H_2O (at 105°).	H_2O (at 250—300°).	Loss on ignition.	Total.
43·32	25·50	trace	26·49	0·17	0·14	4·70	100·32

L. J. S.

Analyses of Biotite and Hornblende from Japan. By Bundjirō Kotō (*Zeit. Kryst. Min.*, 1895, **25**, 287; from *Journ. Coll. Sci., Imp. Univ., Tōkyō*, 1893, **5**, 225).—These minerals, from the amphibole- and biotite-granites, are described in a paper on the Archæan formation of the Abukuma Plateau. The biotite (I) is dark brown, and almost opaque, and is nearly optically uniaxial; Hida's analysis shows it to be lepidomelane. The hornblende (II) is bluish-green in colour, and with only feeble pleochroism.

	SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	Mn_3O_4.	Na_2O.	K_2O.	Total.
I.	36·60	17·05	21·29	trace	10·36	0·70	5·39	8·49	99·88
II.	45·61	4·47	8·92	26·40	11·44	—	2·26	0·79	99·89

L. J. S.

Analyses of Ottrelite, Pyroxene, Garnet, Epidote, Scolecite, and Xenotime. By L. G. Eakins (*Bull. U.S. Geol. Survey*, 1893, No. 113, 111—112).—Ottrelite (I) from the Ottrelite-phyllite rock occurring at Liberty, Frederick Co., Maryland. Pyroxene (II), Garnet (III), Epidote (IV), Scolecite (V), all from Italian Peak, Gunnison Co., Colorado.

	I.	II.	III.	IV.	V.
SiO_2	23·40	47·53	36·88	37·22	45·90
TiO_2	1·19	—	—	—	—
Al_2O_3	39·31	9·88	10·34	24·09	26·51
Fe_2O_3	5·14	1·79	17·51	12·80	—
FeO	21·94	0·91	—	0·79	—
MnO	trace	trace	—	0·11	—
CaO	trace	25·46	34·85	23·36	14·17
MgO	2·18	14·43	0·43	trace	trace
Na_2O	0·20	trace	trace	0·06	trace
K_2O	0·20	—	—	—	—
H_2O	6·81	0·30	0·21	1·61	13·79
F	—	—	—	0·06	—
P_2O_5	trace	—	—	—	—
	100·37	100·30	100·22	100·10	100·37
Sp. gr.	—	3·312	3·721	3·452	2·247

Xenotime from the gold washings at Brindletown, North Carolina (Abstr., 1894, ii, 54); gave, on analysis,

	SiO_2.	ZrO_2.	UO_2.	ThO_2.	Al_2O_3.	Fe_2O_3.	$(LaDi)_2O_3$.	$(YEr)_2O_3$ (mol. wt. 260).	CaO.	P_2O_5.	F.	H_2O.	Total.	Sp. gr.
Green....	3·46	1·95	4·13	trace	0·77	0·65	0·93	56·81	0·21	30·31	0·06	0·57	99·85	4·68
Brown...	3·56	2·19	1·73	trace	1·57	2·79	0·77	55·43	0·19	29·78	0·56	1·49	100·06	4·46

L. J. S.

Analyses of Nickel-iron sulphide, Bauxite, Felspars, and Piedmontite. By William F. Hillebrand (*Bull. U.S. Geol. Survey*, 1893, No. 113, 109—111).—*A nickel-iron sulphide* from Worthington mine, 25 miles west of Sudbury, Ontario. Greyish with a cast of yellow. Not pyrrhotite; possibly a mixture of pyrites and polydymite.

Fe.	Ni.	Mn.	S.	SO_3.	CO_2 (calc. from CaO).	CaO.
38·36	4·57	0·10	45·11	0·95	1·49	1·91

MgO.	Insol.	H_2O (at 100°).	Total.
0·41	4·80	0·55	98·25

Bauxite from near Jacksonville, Calhoun Co., Alabama; I, red, II, white. Lime, magnesia and alkalis were not looked for.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	P_2O_5.	H_2O (at 100°).	H_2O (on ignition).	Total.
I.	10·25	2·53	41·00	25·25	trace	0·65	20·43	100·11
II.	21·08	2·52	48·92	2·14	trace	0·45	23·41	98·52

Felspars from the pegmatite veins in the gneiss at Jones' Falls, Baltimore, Maryland; I, white albite, composition Ab_4An_1; II, flesh coloured microcline; III, greenish microcline. These are described in *Johns Hopkins Univ. Circulars*, 1893, **12**, 97.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	BaO.	MgO.	K_2O.	Na_2O.
I.	63·72	22·26	trace		3·58	—	0·06	0·76	8·98
II.	65·06	18·41	trace		0·26	0·13	0·04	14·30	1·60
III.	68·48	16·11	0·20	0·17	0·23	0·05	0·03	12·99	1·27

	H_2O (at 100°).	H_2O (above 100°).	Total.
I.	0·09	0·43	99·88
II.	0·04	0·26	100·10
III.	0·06	0·26	99·85

All these contain traces of strontium and lithium; in III quartz was not wholly separated.

Piedmontite from rhyolite at Pine mountain, near Monterey station, Maryland; contains a little admixed quartz.

SiO_2.	Al_2O_3.	Ce_2O_3.	X_2O_3. (Mol. wt. 295).	Fe_2O_3.	Mn_2O_3.	MnO.	PbO.
47·37	18·55	0·75	1·28	4·02	6·85	1·92	0·14

CuO.	CaO.	MgO.	K_2O.	Na_2O.	Li_2O.	H_2O (at 100°).	H_2O (above 100°).	P_2O_5.	Total.
0·11	15·82	0·25	0·68	0·23	trace	0·14	1·94	trace	100·05

L. J. S.

Basalt from Bondi, N.S.W. By J. Milne Curran (*Journ. and Proc. Roy. Soc., N.S.W.*, 1894, **28**, 217—231).—This rock, which contains olivine, augite, plagioclase, magnetite, sodalite, apatite, mica and a glassy base, is easily gelatinised by hydrochloric acid, 56·4 per cent. being soluble, and the solution on evaporation deposits numerous cubes of sodium chloride. Calculated from the chlorine, the amount of sodalite in the rock is 8 per cent., this requires 1·92 per cent. of soda; as the other minerals (felspars) containing sodium are only present in small quantity, some of the soda is supposed to exist in the glassy base. The fresh rock, of sp. gr. 2·94, gave analysis I, and the decomposed rock II.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	Na_2O.	K_2O.	TiO_2.	Cl.	H_2O.	Total.
I.	43·5	14·60	5·40	8·28	8·70	6·16	7·38	2·95	0·10	0·37	2·50	99·90
II.	42·0	40·2	trace	—	nil	nil	4·4	1·6	—	—	12·00	100·2

I contains also traces of phosphoric acid, and I and II traces of chromic oxide. L. J. S.

Analyses of Leucite-basalt from Vesuvius. By ALBERT THORPE (*Chem. News*, 1895, **72**, 53).—Analyses of leucite-basalt, from Vesuvius, gave

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	TiO_2.	P_2O_5.	Total.
I.	47·23	18·23	4·21	4·49	1·36	8·63	4·68	8·00	2·63	0·23	0·31	100·00
II.	47·32	18·00	4·23	4·31	1·42	8·51	5·03	7·92	2·70	0·36	0·20	100·00

The sp. gr. of the rock varied from 2·653 to 2·721. L. J. S.

A Tempered Steel Meteorite. By EDWARD GOLDSMITH (*Proc. Acad. Nat. Sci., Philadelphia*, 1893, 373—376).—This meteorite, weighing 267 lbs., was brought from near Godhaven, Disko Island, Greenland, by the Peary Expedition of 1891; when received it appeared quite fresh, but it soon became cracked and fell to pieces. These pieces were easily separated into hard metallic granules (73·8 per cent. of the whole) and a magnetic powder. The granules were extremely hard and difficult to cut (no diamond was found), but on being heated and slowly cooled, they became soft, hence the above title to the paper; their composition is given as

Fe.	Ni.	Troilite.	Magnetite.	Silicate.	Sp. gr.
66·79	2·32	0·52	25·96	4·41	6·14

Traces of carbon, phosphorus and chromium were found, but neither copper nor cobalt, which are found in the Disko terrestrial iron, together with more carbon than here. The composition of the powder is given as

Fe.	NiO.	Fe_2O_3.	$Fe_3O_4,2SO_3$.	Silicate.	H_2O.	Sp. gr.
25·58	0·31	56·30	4·28	10·10	3·43	4·73

The "$Fe_3O_4,2SO_3$" is called "magnetic sulphate," as the whole of the powder is stated to be magnetic. L. J. S.

Occurrence of Fluorine in certain Mineral Waters. By José Casares (*Zeit. anal. Chem.*, 1895, **34**, 546—548).—The sulphuretted mineral waters of Lugo and Guitiriz (Galicia, Spain) contain so much fluorine that it can readily be detected in the residue of 500 c.c. of the water. Quantitative estimations in the Guitiriz water gave, by Fresenius's method, 0·02344, 0·02806, and 0·02277 gram of sodium fluoride per litre; by Carnot's method (Abstr., 1892, 911), 0·0268 gram. A single estimation in the Lugo water showed 0·0249 gram per litre. The author inclines to the belief that the presence of fluorides in mineral waters is more general than is commonly supposed. M. J. S.

Physiological Chemistry.

Cutaneous Respiration in the Frog. By E. Waymouth Reid and Frederick J. Hambly (*J. Physiol.*, 1895, **18**, 411—424).—The vital or secretory activity of the epithelium lining the air passages has been recently called on to account for some of the phenomena of respiration. The present research deals with this question in connection with the skin of the frog, which in that animal forms an important coadjutor to the lungs. The apparatus and method used are described at length: the principle of the method is, that the skin just removed from the animal is used as a diaphragm, across which the amount of gases passed is estimated. The amount of carbonic anhydride which passes through the skin, from the inner to the outer surface, is practically the same as that which passes in the reverse direction. There is thus no evidence of secretory activity.

W. D. H.

Action of Mustard and Pepper on Digestion. By Gottlieb (*Exp. Stat. Record*, 1895, **7**, 148—149; from *Verhandl. Natur. Med. Ver., Heidelberg*, 5).—Observations of the constant and regular secretion of the pancreatic juice, by means of a canula in the pancreatic duct of a rabbit, showed that the introduction of mustard or pepper into the stomach caused the secretion to be three or four times as large; the juice was somewhat abnormally watery, but possessed the same digestive properties. N. H. J. M.

Wandering Cells of the Alimentary Canal. By W. B. Hardy and F. F. Wesbrook (*J. Physiol.*, 1895, **18**, 490—524).—The main bulk of the paper is histological, being a continuation of former work. The cells fall into the three main classes of oxyphile, basophile, and hyaline cells. A noteworthy fact made out is the existence of a layer of basophile cells at the base of the epithelial cells covering the villi. A large number of animals were investigated; in rats fed on a flesh diet, the cells altered to the carnivorous type, the basophile cells becoming more numerous, and scattered and migrated in large numbers between the epithelium cells; the granules of the oxyphile cells were scarcely preserved by absolute alcohol, and did not stain readily. The absorption of iron appears to be carried out by the hyaline cells.

W. D. H.

The Lactase of the Small Intestine. By FRANZ RÖHMANN and J. LAPPE (*Ber.*, 1895, **28**, 2506—2507; compare Pautz and Vogel, Abstr., 1895, ii, 403).—The authors have investigated the action of the small intestines of calves, oxen, and young and old dogs, on solutions of milk sugar. The intestines were also extracted with chloroform, with thymol solution, and with sodium fluoride solution, and the action of these extracts on the milk sugar studied. In all cases, with the exception of ox intestine, after digestion for several hours, dextrose could be identified in the solution by means of its osazone. Alcohol precipitates from the above extracts of the intestine a substance which will also hydrolyse milk sugar.

Quantitative experiments as to the amount of dextrose formed were also made.

J. J. S.

Influence of the Vaso-motor Nervous System on Metabolism. By F. TANGL (*Pflüger's Archiv*, 1895, **61**, 563—582).—Dogs were curarised, their spinal cord divided in the neck, artificial respiration being kept up. The peripheral end of the spinal cord was stimulated, and observations made on the rectal temperature, and gaseous interchanges before and during stimulation. The general conclusion drawn is that electrical stimulation of the whole vasomotor system of nerves produces a fall of the temperature of the internal parts of the body, and that this is due not only to increased loss of heat, but also to diminished development of heat.

W. D. H.

Metabolism. By IMMANUEL MUNK (*Pflüger's Archiv*, 1895, **61**, 607—619).—This is a supplementary paper to one previously published (Abstr., 1895, ii, 78), and is chiefly concerned with answering various criticisms, and explaining some parts more fully. The previous general conclusions of the author are maintained.

W. D. H.

Iron in Food. By RALPH STOCKMAN (*J. Physiol.*, 1895, **18**, 484—489).—Almost the only data, with regard to the amount of iron in food, are those of Boussingault (*Compt. rend.*, **74**, 1352), and his results are too high. The great difficulty in work of this kind is complete incineration; which, in the present research, was accomplished by heating the ash with a mixture of hydrochloric and sulphuric acids; the residue was then taken up with dilute sulphuric acid, reduced with zinc, and titrated with potassium permanganate.

The ordinary daily diet was found to contain about 9 or 10 milligrams of iron; but in chlorotic people, who take but little food, the amount was about 3 milligrams. The following articles of diet were also analysed in the same way.

Milk from 2 to 4·3 milligrams per litre.
Oatmeal 3·5 milligrams per 100 grams (dried).
Bread from 0·61 to 0·85 milligrams per 100 grams (dried).

Yellow ox marrow 2·5 to 4 milligrams per 100 grams (dried).
Red calf marrow 7·6 to 8·7 " " "
Beefsteak 3·9 milligrams per 100 grams (dried).

W. D. H.

Sugar as a Food. By B. T. STOKVIS (*Brit. Med. J.*, 1895, ii, 1280—1282). By UGOLINO MOSSO (*ibid.*, 1282). By VAUGHAN HARLEY (*ibid.*, 1282—1284).—These three papers constituted the opening of a discussion at the annual meeting of the Brit. Med. Assoc. (1895). Harley and Mosso support the doctrine that sugar is the great source of muscular energy; this, however, is strongly contested by Stokvis, who severely criticises the ergographic method. W. D. H.

Mannan as Human Food. By C. TSUJI (*Bul. Coll. Agric. Imp. Univ., Tokyo*, 1894, **2**, 103—105).—From the tuberous roots of *Conophallus konyaku*, a food, consisting of colourless, gelatinous tablets, is prepared, and is largely consumed in Japan. It is made by mixing the ground root with slaked lime (1 part) and water (2 parts), after which it is boiled with lime water until it forms a gelatinous mass.

When boiled with 3 per cent. sulphuric acid, the root yielded 55·86 per cent. of mannose, assuming the whole of the sugar present to be mannose, as is very probable. The mannan present in the root must be digested by the enzymes in the intestines, and transformed into mannose or a dimannose, corresponding with the maltose made from starch. Attempts to convert the mannan of *konyaku* into a sugar by means of diastase from malt were unsuccessful.

N. H. J. M.

Feeding Experiments on Sheep. By CHARLES D. WOODS and C. S. PHELPS (*Ann. Rep. Storrs Agric. Exp. Stat., Conn.*, 1893, No. 6, 28—42, and 1894, No. 7, 92—106).—In the first series of experiments, five sheep were fed for 12 weeks on a wide ration (maize meal, hay, and turnips), another lot of five being fed with a narrow ration (linseed, pea and maize meal, bran, and hay), after which they were slaughtered, weighed, the various portions separated, and analysed. Similar sheep were slaughtered and analysed at the commencement of the experiments. The second set of experiments was similar, but the sheep were kept in a yard in groups instead of in pens.

The following tables summarise (1) the daily amount of digestible food actually eaten to produce a gain of 1 lb. live weight; (2) the percentage composition of the fresh edible meat produced under the different conditions in both years.

	Organic matter.	Proteïn.	Fat.	Carbohydrates.	Heat value.
	lbs.	lbs.	lbs.	lbs.	cal.
Wide ration, 1893....	6·99	0·82	0·33	5·84	14000
" 1894....	7·31	0·81	0·38	6·13	14500
Narrow ration, 1893..	6·02	1·23	0·19	4·60	11500
" 1894..	6·20	1·30	0·25	4·65	12100

	In dry meat.			In fresh meat.			
	Proteïn.	Fat.	Ash.	Water.	Proteïn.	Fat.	Ash.
At commencement 1893	41·4	56·1	2·5	58·4	17·3	23·4	1·0
" " 1894	36·6	61·4	2·0	55·2	16·3	27·6	0·9
Wide ration, 1893	34·9	63·2	1·9	57·3	14·9	27·0	0·8
" 1894	32·6	65·6	1·8	52·0	15·6	31·5	0·9
Narrow ration, 1893 ..	36·5	61·5	2·0	58·8	15·0	25·4	0·8
" 1894 ..	35·8	62·2	2·0	54·1	16·1	28·9	0·9

The results show that the character and composition of meat depends largely on the food. The 1893 results illustrate strikingly the fact that water and fat can replace each other to a great extent; whilst the proteïn is about the same in both series (wide and narrow rations), the meat of the narrow ration animals contains 1·5 per cent. more water and 1·6 per cent. less fat than the flesh of the wide ration sheep. Otherwise the results are not very decisive.

N. H. J. M.

Feeding Experiments with Brushwood. By E. RAMM (*Bied. Centr.*, 1895, **24**, 415—448; from *Landw. Jahrb*, 1894, **23**, 789—834).—In consequence of the scarcity of food in 1893, experiments were made at Poppelsdorf in which cows, horses, sheep, and goats were partially fed with brushwood. Cows proved to be most suitable for the experiments, as they consumed the material in sufficient quantity, and did not, with one exception, suffer from indigestion. They received a constant ration of sugar beet, dried brewers' grains, earth-nut cake and salt, together with wheat chaff (5 kilos.), which was successively replaced by birch (9—12), copper beech (6—11), and hornbeam brushwood (4—5 kilos.) per day. The brushwood was freshly ground each day, and was given in different degrees of fineness.

The effect of brushwood was to decrease the yield of milk, raise the percentage of fat, and, in some cases, to shorten the period of lactation. It was of great importance to have the wood very finely ground. Only the buds and bark seem to have a value as food, a large portion of the wood being found undigested in the fæces. Of the different woods, birch gave the best, hornbeam the worst, results. The following numbers show the percentage composition of fine beech brushwood meal (1), medium and coarse beech (2), copper beech (3), hornbeam (4).

	Dry matter.	Crude proteïn.	Digestible proteïn.	Amide nitrogen.	Crude fat.	Crude fibre.	N-free extract.	Pure ash.
1	58·47	3·65	0·70	0·017	3·29	21·24	24·84	0·99
2	62·81	3·35	1·04	—	2·66	27·15	28·54	0·96
3	72·23	3·07	0·68	0·059	1·20	39·77	26·77	1·04
4	81·67	3·43	1·39	0·039	0·94	46·02	30·03	1·14

The percentage amount of lime was (2) 0·389, (3) 0·488, (4) 0·377; of magnesia, (2) 0·107, (3) 0·103, (4) 0·158; of phosphoric acid, (2) 0·143, (3) 0·146, and (4) 0·125.

The results show that in years of scarcity of the ordinary foods, brushwood deserves attention. Some animals, however, cannot be fed with it at all, and it is unsafe to employ it for long periods as an exclusive substitute for forage. N. H. J. M.

Examination of Foods from Farms where Cattle suffered from Brittleness of the Bones. By Oscar Kellner, A. Köhler, and F. Barnstein (*Bied. Centr.*, 1895, **24**, 441—443; from *Sächs. landw. Zeit.*, 1894, No. 15).—Analyses were made of five samples of hay and three of straw, produced in the dry season of 1893.

The amount of phosphoric acid was, in every case, very low. There is no direct evidence to show that bone brittleness can arise from want of phosphates, but Förster, Stillnig, and von Mering proved that it may be caused by insufficient supply of lime. Inasmuch as lime and phosphoric acid always occur in the same relative amounts in the bones of young animals, a deficiency of phosphates in the food may cause an insufficient deposit of lime in the bones, and with older animals, deficiency may cause a withdrawal of both phosphoric acid and lime from the bones, which would thus become brittle. The disease can generally be cured by good feeding and a daily allowance of bone meal (30 to 60 grams); on farms where bone softening prevails, the crops should be well manured, especially with soluble phosphates.

Fittbogen showed that plants, when insufficiently watered, are unable to take up phosphoric acid in sufficient amounts.

N. H. J. M.

Action of Drugs on the Embryonic Heart. By John W. Pickering (*J. Physiol.*, 1895, **18**, 470—483).—This is a series of further experiments in answer to certain criticisms by His (*Centr. Physiol.*, 1894, **8**, 11). The chief points made out are the following:—The combined accelerator and augmentor action of small doses of alcohol on the heart of the embryo chick, reaches its maximum at about 38°; at low temperatures, even small doses of alcohol rapidly depress the cardiac rhythm. A temperature of 40° and upwards has a marked influence on the action of alcohol on the embryonic heart; the frequency becomes too rapid to record, and the force of the beats is much diminished. A dose of alcohol, which, at 20°, is a depressant, has an accelerator action at higher temperatures. The maximum accelerator action of alcohol is attained more rapidly at a lower than at a higher temperature; the depressant action is affected similarly. The cardiac stoppage produced by moderate doses of alcohol at a low temperature can be usually removed by heating, or by the application of electrical stimuli; similarly, the cardiac stoppage produced by small doses of alcohol at a high temperature, can sometimes be removed by cooling; electrical stimulation, however, induces a condition not unlike tetanus. A dose of 0·1 milligram of veratrine (dissolved in 0·65 per cent. sodium chloride solution) acts as a depressant to the embryonic heart at 20°, but, at a temperature above 30°, produces a marked acceleration of cardiac frequency; a dose of 0·3 milligram of veratrine is fatal at 20°, whilst at 42°, the average reduction of cardiac frequency is two beats per minute. Ammonia, acting at 38°, has a marked accelerating action.

Former experiments have shown that in early embryos, before the heart nerves are developed, mascarine has no action; it, however, depresses the cardiac rhythm of chick embryos older than 200 hours, its action culminating in diastolic stoppage, which can be removed by the subsequent application of atropine sulphate, as in frogs. The restoration is only partially complete, if mascarine stoppage has been induced. The action of mascarine nitrate is more marked at subnormal temperatures, and can often be removed by the application of heat. W. D. H.

Formation of Blood from Inorganic Iron. By Jos. A. Kunkel (*Pflüger's Archiv*, 1895, **61**, 595—606).—As a contribution to the disputed question whether inorganic iron is absorbed and contributes to blood (hæmoglobin) formation, experiments were made on two puppies; one received milk, in which the amount of iron was ascertained, the other the same food *plus* iron. The milk contained about 1 milligram of metallic iron (1·4 milligram Fe_2O_3) per litre. The extra iron given daily was 30 drops of liquor ferri albuminat of the German Pharmacopœia (= 4·4 milligrams of iron). During life, the blood was examined at weekly intervals. After death, other organs were submitted to analysis. The main facts are given in the following table. It shows a greater amount of iron in the dog to which iron had been administered.

	Dog A, with iron.		Dog B, without iron.	
Percentage of Fe_2O_3 in blood in successive weeks	1. 0·0486	5. 0·0363	1. 0·0448	5. 0·0234
	2. 0·0388	6. 0·0384	2. 0·0503	6. 0·0227
	3. 0·0286	7. 0·0348	3. 0·0259	7. 0·0195
	4. 0·0334	—	4. 0·0303	—
After death.	Weight.	Total Fe_2O_3.	Weight.	Total Fe_2O_3.
	grams	gram	grams	gram
1. Total blood	—	0·0404	—	0·0252
2. Liver	133·8	0·0317	151·2	0·0043
3. Spleen	7·2	0·0043	7·3	0·0013
4. Kidneys	27·0	0·0025	30·2	0·0014
5. Ribs	11·1	0·0011	9·9	0·0001

Physiology of Blood Sugar. By F. Tangl and Vaughan Harley (*Pflüger's Archiv*, 1895, **61**, 551—559).—Most physiologists look on the liver as the source of the sugar in the blood; support is lent to this doctrine by the fact that if the liver is excised or excluded from the circulation, sugar disappears from the blood. Interference with the circulation of the liver by ligature of the intestinal arteries lessens its activity (compare Slosse, *Du Bois Reymond's Arch.*, 1890, 482, on the diminution in urea so produced), and the present experiments in dogs show that this is true for its sugar forming function; the quantity of sugar in the blood markedly diminishing (from 42 to 92 per cent. in different experiments) after the ligature of the arteries in question. W. D. H.

Circulation Time. By GEORGE N. STEWART (*Brit. Med. J.*, 1895, ii, 1287).—The method employed consists in the injection of methylene blue into a vein and watching for its appearance in the carotid artery. It is not necessary to open the artery. This simple method gives identical results with the electrical method of the author. The mean pulmonary time in a dog is 9·55 seconds; and in different animals this varies as the diameter of a sphere of the same mass as the animal, and having the same specific gravity. The circulation time in a man is probably about 15 seconds, which is considerably shorter than that stated by the older experimenters. W. D. H.

Muscular Work and Glycogen. By FR. SCHENCK (*Pflüger's Archiv*, 1895, **61**, 535—543).—Seegen (*Du Bois Reymond's Archiv*, 1895, 242), from experiments on dogs in which he stimulated the nerve of the quadriceps muscle, concludes that the glycogen which disappears will account for only five per cent. of the work done. He looks on the sugar of the blood as the normal source of muscular energy, and glycogen as a reserve called into use only when work is excessive.

The present article traverses these statements, and speaks in favour of Pflüger's theory. The chief objections raised are that the work done in Seegen's experiments was not maximal, and that no proof is given that the glycogen which disappears is burnt up; it might, as indeed Seegen appears to admit, be converted into sugar, how then is the sugar of the blood to be distinguished from that originating from glycogen? W. D. H.

Proteïds of Muscle Plasma. By OTTO VON FÜRTH (*Arch. exp. Path. Pharm.*, 1895, **36**, 231—274).—Muscle plasma was obtained from muscles free from blood by extracting them with physiological salt solution. This coagulated spontaneously, and the clotted proteïd formed is called myogen-fibrin, or myosin-fibrin. The proteïds in the muscle plasma are three in number, namely paramyosinogen 17 to 22 per cent. of the total proteïd, myosinogen or myogen 77 to 83 per cent. of the total proteïd, and traces of serum albumin probably derived from the remains of blood and lymph left in the muscles. The whole paper is written very largely in reference to previous work by Kühne and Halliburton (Abstr., 1887, 984).

The work of Halliburton is confirmed in its main point, namely that there are two proteïds in the muscle plasma, paramyosinogen and myosinogen which enter into the formation of the muscle clot; the action of a specific ferment to bring about this change was not specially investigated. The principal new fact made out is that paramyosinogen passes into this condition of myosin-fibrin directly; whilst in the passage of myosinogen into the state of myogen-fibrin, there is an intermediate soluble stage coagulated by heat at the remarkably low temperature of 40°.

Paramyosinogen is a typical globulin, and is regarded as identical with Kühne's myosin. *Myosinogen* is described as differing from a globulin in many particulars; it is spoken of as a proteïd *sui generis*.

The proteïd in the muscle serum, described as myoglobulin by Halliburton, is not regarded as a definite substance, but only as a part of the myosinogen which has escaped coagulation. The phenomenon described by Halliburton as recoagulation of myosin, is regarded only as a reprecipitation of globulin.

Peptones, albumoses, nucleo-proteïds were not found (compare Whitfield, Abstr., 1894, ii, 358).

The muscle plasma from fishes' muscle contains another proteïd called *myoproteïd*.. It gives the usual proteïd reactions, and is readily digested by gastric juice; it is neither coagulated by heat, nor precipitable by removing the salts by dialysis. It is precipitated by neutral salts like globulins. It is precipitable by acetic acid, but is neither a mucin nor a nucleo-proteïd. The same substance was found in crab's muscle.

W. D. H.

Antagonism between Salts of Calcium and those of Sodium, Potassium, and Ammonium. By SYDNEY RINGER (*J. Physiol.*, 1895, **18**, 425—429).—Milk to which rennet and calcium chloride have been added clots readily, whilst the presence of sodium chloride hinders, or in larger amounts prevents, this action; the chlorides of potassium and ammonium act similarly, but less powerfully than that of sodium. This antagonism is limited to the precipitation of the caseïn as a clot, and does not affect the chemical change from caseïnogen to caseïn produced by the rennet ferment. The same antagonism exists in relation to blood clotting, and to muscular contraction as evidenced by experiments on the frog's heart, only in the last case potassium chloride is a more powerful antagonist than sodium chloride.

W. D. H.

Toxic Substance from the Supra-renal Capsules. By D. GOURFEIN (*Compt. rend.*, 1895, **121**, 311—314).—The glycerol extract of the supra-renal capsules contains proteïds which are precipitated by alcohol, and have little or no toxic effect, together with substances which are not precipitated by alcohol and are highly toxic. As the latter are not decomposed by heat, the capsules can be extracted with hot water, the solution precipitated by alcohol, and the clear liquid evaporated on a water bath. The product when injected subcutaneously causes death in a short time, and seems to act on the central nervous system. The proportion of the poison in the supra-renal capsules is variable, but no similar effects are produced by extracts of the spleen or the muscle of the same animals treated in the same way.

C. H. B.

Succus Entericus of Sheep. By FRITZ PREGL (*Pflüger's Archiv*, 1895, **61**, 359—406).—The intestinal juice has been investigated chiefly in carnivora. The only previous experiments on herbivora were made on a goat by Lehmann, who found the juice had no digestive action. The present experiments were made on a lamb.

The juice was collected by a modification of the Thiry-Vella method, from 3 to 5 grams of juice being obtained from the loop per hour. It is a mucous, strongly alkaline fluid, which is rich in proteïd, and tends, like pancreatic juice, to set into a jelly spontaneously; its specific gravity is about 1·014. It contains about 0·2 per cent. of urea. The following analysis is given in parts per 1000.

Sodium carbonate	3·69
Albumin and globulin	18·09
Albumoses and mucin	1·27
Urea	2·29
Other organic substances	3·31
Ash	1·27
Water	970·05

On proteïds, cellulose, pentoses, and fats, it has no digestive action, but it converts starch and glycogen into dextrose with intermediate dextrins; it inverts cane sugar and maltose, but not lactose.

W. D. H.

Artificial Hydræmic Plethora. By J. B. Leathes (*Brit. Med. J.*, 1895, ii, 1287).—The experiments briefly recorded go against the secretion theory of lymph formation. W. D. H.

Physical Factors in Absorption. By Hartog J. Hamburger (*Brit. Med. J.*, 1895, ii, 1287).—The disappearance of fluids from the serous cavities can take place either by the lymphatic or blood vessels; the process is not one of osmosis, for both isotonic and hypertonic solutions disappear, and Heidenhaim concluded that a vital activity of the epithelium must occur to account for the phenomena. Absorption occurs, however, in a dead animal. The force at work is believed to be imbibition of the molecular kind, such as occurs with gelatin and other homogeneous substances, and this imbibition may be exhibited by the cells or by the cement substance between them; this is of course limited in a dead animal, but in a living one the circulating fluid removes the absorbed liquid.

A working model to illustrate this has been constructed as follows: a cylinder of gelatin is taken to represent a capillary, and enclosed within a wider glass cylinder to represent the tissue spaces; both cylinders are now filled with a fluid like serum, and if a stream is kept up through the gelatin cylinder, the fluid is absorbed from the space between the two cylinders, and is replaced by fresh fluid allowed to flow in through a side tube. The hydrostatic pressure of the fluid is also to be taken into account. W. D. H.

Potassium Thiocyanate in Saliva. By Immanuel Munk (*Pflüger's Archiv*, 1895, **61**, 620—622).—In reference to Nencki's work on thiocyanic acid in the stomach, it is pointed out that in the dog, it is absent in the saliva; horse's saliva is also free from it.

W. D. H.

Elimination of Calcium Compounds in Rachitis. By William Oechsner de Coninck (*Compt. rend.*, 1895, **121**, 262—263).—

In cases of rachitis, the quantity of calcium in the urine gradually diminishes in the same manner as the quantity of magnesium. When elimination of magnesium is small, however, that of calcium is relatively high, and this result has led the author to conclude that in rachitis the calcium of the osseous system is partially replaced by magnesium. Chabrié has arrived at a similar conclusion with respect to osteomalagia (compare Abstr., 1895, ii, 455).

C. H. B.

Urobilin. By ADOLF JOLLES (*Pflüger's Archiv*, 1895, **61**, 623—637).—Urobilin was first described by Jaffé in febrile urine, later, Maly obtained from bilirubin, by reduction, a substance he called hydrobilirubin, which he considered to be identical with urobilin, and Vierordt pointed out that normal urine contains other pigments as well. MacMunn distinguishes between normal urobilin and febrile or pathological urobilin, which differ in their optical characters; fresh urine containing little or no urobilin often becomes darker on exposure to the air, and this he considers to be due to the oxidation of a chromogen, urobilinogen. Both MacMunn and Hoppe-Seyler have obtained urobilin by artificial means from hæmatin. MacMunn and Le Nobel both doubt the absolute identity of urobilin and hydrobilirubin. Pathological urines, dark from the presence of supposed bile-pigment, have shown in many cases, on examination, that the increase of urobilin is the cause of the deep colour of the urine (urobilin-icterus); whilst recently A. Katz (*Wiener Med. Woch.*, 1891, Nos. 28—32) has shown that this increased excretion of urobilin is due to metabolic changes having their seat in the liver, which if they are prolonged produce harmful changes in the liver cells.

The present paper points out that urines containing a small amount of bile-pigment will, after standing exposed to the air for several days, no longer show any bilirubin whatever, urobilin having taken its place. The source of the urobilin in the fæces is also doubtless the bile-pigment, unaltered bile-pigment never occurring in normal fæces. Urinary urobilin shows two well-marked characters: (1) a green fluorescence, which appears when the urine is rendered alkaline with ammonia and a few drops of zinc chloride solution are added; (2) a well-defined absorption band between the lines *b* and F; it was necessary to determine if any other urinary pigments give the same characters. Gmelin's test for bile-pigment consists in adding fuming nitric acid; the colour changes to blue, violet, red, brown, and finally yellow, the yellow end product of oxidation being called choletelin; these coloured products, with the exception of the last, when reduced by zinc and hydrochloric acid, all show absorption bands, and give with ammonia and zinc chloride a green fluorescence. The absorption bands given by the red and brown pigments are in the neighbourhood of the F line, but not so sharply defined as in the urobilin spectrum, which, however, they closely resemble. In some urines, pigments can be separated which give all the characters of the red and brown oxidation products of bilirubin, whilst others again yield a substance identical with choletelin, which is the highest oxidation product of bilirubin, and is, in fact, regarded as the yellow pigment of normal urine; for the details of the method of separating the pigment from urine by lead acetate, &c., the original paper must be consulted. In conclusion, two classes of urobilins are distinguished from one another, *pathological urobilins*, which are reduction products of bilirubin, and *physiological urobilins*, which are oxidation products of bilirubin. These terms are used in a different sense from that in which MacMunn uses the terms normal and pathological urobilin; but the idea that normal or physiological urobilin is an oxidation product of blood or bile-pigment should be credited to MacMunn. Among the physiological urobilins is reckoned the substance which darkens on exposure to the oxygen of the air.

The source of physiological urobilin is considered to be the bile-pigment; pathological urobilin has usually the same origin, but it can come from blood pigment directly after extravasations of blood.

W. D. H.

Action of Anæsthetics on Nerve. By AUGUSTUS D. WALLER (*Proc. Physiol. Soc.*, 1895, 45—47).—A frog's sciatic nerve is laid on two pairs of electrodes, one pair being exciting, the other pair non-polarisable, and leading to a galvanometer; on excitation, the electrical change in the piece of nerve connected with the electrodes is noticed. The whole is contained in a chamber, through which gases or vapours in known amount can be passed. In large amount, carbonic anhydride produces primarily abolition, secondarily augmentation of the effect observed, whilst in small amount (for instance, with expired air) there is primarily augmentation. Ether produces prolonged abolition, followed in time by recovery, whilst chloroform produces abolition, but no recovery occurs; other anæsthetics were also investigated.

The most important point made out is regarded as evidence of the production of carbonic anhydride in the nerve itself, consequent on activity, for after prolonged excitation the effects of intermittent stimulation is to produce an increase of the galvanometric change, just as though a small percentage of the gas had been added to the surrounding air.

W. D. H.

Action of Carbonic Oxide on Man. By JOHN S. HALDANE (*J. Physiol.*, 1895, **18**, 430—462).—The experiments made by the author on himself show that the symptoms caused by carbonic oxide depend on the extent to which the hæmoglobin has been saturated; the percentage saturation of the hæmoglobin of the red corpuscles may be estimated during life by a simple colorimetric method. Carbonic oxide is a "cumulative" poison. The symptoms do not become sensible during rest until the corpuscles are about one-third saturated; with half saturation, the symptoms (respiratory distress, headache, &c.) become urgent. Similar symptoms are experienced by mountaineers at high altitudes.

When air containing this gas is breathed, about half of that actually inhaled is absorbed, except when absorption is coming to a standstill. The time required for the production of sensible symptoms in an adult depends on the time required for the inhalation of about 660 c.c., or the absorption of about 330 c.c. of the pure gas; this time in different animals varies with the respiratory exchange per unit of body weight, and is about 20 times as long in a man as in a mouse; hence a mouse can be used as an indicator in a coal mine before men penetrate into it.

The maximum amount of carbonic oxide capable of being absorbed by the blood from air containing a given small percentage depends on the relative affinities of oxygen and carbonic oxide for hæmoglobin, and the relative tension of the two gases in arterial blood. The affinity of carbonic oxide for hæmoglobin is about 140 times that of oxygen, and the oxygen tension of human arterial blood is, approximately, 16 per cent. of an atmosphere. Distinct symptoms, appreciable during rest, are not produced until about 0·05 per cent. of the gas is present; with about 0·2 per cent. urgent symptoms are produced. With a given percentage of carbonic oxide in air, a certain percentage saturation of the blood is reached within about 150 minutes, and is not afterwards exceeded, however long the breathing of the vitiated air is continued. The disappearance of the gas from the blood when fresh air is again breathed is always much slower than the absorption of the gas, and is chiefly due to dissociation of carbonylhæmoglobin by the mass influence of the oxygen in the pulmonary capillaries, and consequent diffusion of the gas outwards through the alveolar epithelium. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Fermentation by Apiculated Yeast: Influence of Aëration on Fermentation by Elliptical Yeast at a High Temperature. By M. Rietsch and M. Heiselin (*Compt. rend.*, 1891, **121**, 378—380).—When musts prepared from dry grapes, with or without the addition of saccharose, are fermented under similar conditions, the ratio of alcohol produced to sugar destroyed is higher with elliptical yeast than with apiculated yeast.

Moderately dilute musts, fermenting with elliptical yeast at about 36°, are not appreciably affected by passing a current of air through them, but with stronger musts, the aëration produces a distinct increase in the amount of alcohol, and the beneficial effect is greater the stronger the must. In all cases, however, the advantage gained by cooling the liquid to about 30° is much greater than that resulting from aëration, although the latter is still beneficial. A combination of the two processes gives the best results, and is especially to be recommended in hot countries, in which the musts are usually somewhat concentrated. Precautions must of course be taken against acetic fermentation. C. H. B.

Effect of abundant Application of Nitrogen on the Assimilation and Respiration of Plants. By H. Müller (*Bied. Centr.*, 1895, **24**, 454—456; from *Jahresber. deut.-schweiz. Versuchs-stat., Wädensweil*, **3**, 52).—The results of the experiments which were made with potatoes and sugar beet were as follows. The application of large amounts of nitrogen to the plants caused increased leaf-development with greater percentage of chlorophyll; starch formation in the leaves was impeded, the starch was more quickly dissolved, and there was less storage of reserve substances; the amount of glucose was increased, and there was increased decomposition of nitrogen compounds, resulting in increased respiration of all parts, and an increased growth.

With both plants, excessive or exclusive nitrogenous manure should be avoided. Roots which have been too heavily manured with nitrogen should be used first, as they are the most subject to loss through respiration. N. H. J. M.

Consumption of Asparagine in the Nutrition of Plants. By Y. Kinoshita (*Bull. Coll. Agric., Imp. Univ., Tokyo,* 1895, **2**, 196—199).—According to C. O. Müller (Abstr., 1887, 70), regeneration of proteïds from asparagine can only take place in green leaves, light and the nascent state of carbohydrates being essential. In order to ascertain whether the process would go on in the dark, shoots of soja bean, which are rich in asparagine, were fed with organic solutions, and examined from time to time for asparagine. The solutions selected were: (1) 1 per cent. methylic alcohol with one-tenth of its bulk of saturated gypsum solution; (2) 1 per cent. glycerol solution with gypsum, and (3) glucose solution. When placed in these solutions, the plants were 20—27 cm. long, and the roots and stems were rich in asparagine; the cotyledons had been removed. Tests for reserve albumin, made during the experiment, showed it to be absent in the control experiment, and present in considerable amount in the shoots grown in sugar and glycerol. After about four weeks, the shoots of the control experiments showed a higher percentage of asparagine in the dry matter (28·7) than at the commencement (21·5 per cent.), whilst the shoots in methylic alcohol and glycerol solutions showed a respective reduction to 18·9 and 13·7 per cent. The production of dissolved proteïds was thus coincident with decrease of asparagine. The increase in amount of asparagine in the control experiments was probably due to production from other amides. A less increase was observed in another control experiment (24·0) in which the cotyledons had not been removed, probably due to the protecting effect of the galactans and other carbohydrates gradually becoming soluble.

Glycerol and methylic alcohol supplied to the roots can, therefore, not only hinder the production of asparagine in the shoots, but also diminish the amount already present. Glycerol is the more effective; it also forms sugar. Since the shoots grew better in these solutions than in water, and showed the presence of dissolved proteïds, it may be assumed that both methylic alcohol and glycerol can regenerate proteïds from asparagine. Moreover, light cannot have any direct action in supporting the process, although it is indirectly of great importance in yielding the necessary carbohydrates.

N. H. J. M.

Assimilation of Nitrogen from Nitrates and Ammonium Salts by Phaenogams. By Y. Kinoshita (*Bull. Coll. Agric., Imp. Univ., Tokyo,* 1895, 200—202).—Barley was sown in sand contained in three pots, and kept dark. After 16 days, the plants of one pot were taken out and analysed, whilst those of the second and third pots were watered with a 1 per cent. solution of ammonium chloride and a solution containing an equivalent amount of sodium nitrate respectively; 500 c.c. of each solution was used during the week the experiment lasted. In a second experiment, maize plants, nearly 40 cm. long, were placed in solutions of ammonium and sodium nitrates (containing 1 per cent. of nitrogen), control plants being placed in distilled water. The following total amounts (in grams) of nitrogen, and of nitrogen as asparagine, were found.

	At commencement.		At conclusion.	
	Total.	As Asparagine.	Total.	As Asparagine.
Barley in AmCl ..	3·512	0·656	4·436	2·027
„ $NaNO_3$..			4·923	0·977
Maize in $AmNO_3$..	4·13	0·38	4·23	0·73
„ $NaNO_3$ ..			4·15	0·24

The results of these preliminary experiments make it evident that ammonium salts are transformed into asparagine, whilst nitrates are not, and it seems certain that asparagine is the form in which the excess of nitrogen, originally in ammonium salts, is stored up.

N. H. J. M.

Reserve Proteïn in Plants. By G. Daikuhara (*Bull. Coll. Agric., Imp. Univ., Tokyo*, 1895, **2**, 189—195; compare Abstr., 1895, ii, 128). —The plants previously examined (*loc. cit.*) for active albumin were collected in the spring. It seemed possible that, owing to transportation, leaves found rich in active albumin in the spring might no longer contain it in the autumn, or that, on the other hand, plants of rapid growth which gave a negative reaction in the spring might accumulate active albumin in the autumn. An examination of a number of plants collected in the autumn gave, however, generally, results similar to those previously obtained, except that plants which gave a positive result in the spring usually showed less active albumin in the autumn.

Repeated examination of partly dead leaves showed that they always produced proteosomes with caffeïne in the healthy cells, even when very close to the dead portions, but the dead portions invariably gave negative results.

The frequent occurrence of active albumin in the flower may be of importance to seed formation; so far, active albumin has generally been found only in the epidermis of the seeds and fruits examined.

N. H. J. M.

Formation of Proteïds in Plant Cells. By Oscar Loew (*Bull. Coll. Agric., Imp. Univ., Tokyo*, 1894, **2**, 43—67).—*Micro-organisms and Mould-Fungi.*—The behaviour of aërobic microbes and moulds towards different organic compounds indicates that the proteïds and protoplasma remain in one species the same, and that the formation of proteïds commences with relatively simple atomic groups.

As regards carbon compounds, the nutritive quality of acids is increased by the entrance of alcoholic hydroxyl, that of alcohols increases with the number of HO-groups; aldehyde and ketone groups increase the nutritiveness, the lower members of the fatty acids being more assimilable than the higher. Unsaturated ring systems are generally unfavourable, whilst some compounds (such as quinic acid) containing a saturated benzene ring are very nutritive. Pyridine, pinacone, ethylenediamine, amidoacetal, glyoxal, meconic and oxalic acids do not support bacterial growth; acetoxime, diacetonamine, citraconic and maleïc acids do, but only with difficulty; at the same time, none of these compounds is so poisonous as to kill the bacteria, if well nourished. It is of interest that whilst with maleïc acid it takes weeks to develop bacteria, fumaric acid supports bacteria well; in citraconic acid there was no development for six weeks. Comparing the different monhydric alcohols, it was found that whilst 1 per cent. methylic alcohol readily develops bacterial growth, amylic alcohol has to be used diluted to 0·1 per cent. The fatty acids decrease in nutritive properties as their molecular weight increases; formic acid, however, seems to be available only in the case of one kind of bacterium (*Centr. f. Bacteriol.*, **12**, No. 14); formaldehyde is poisonous, but its combinations with hydrogen sodium sulphite, and with ammonia can be utilised by a bacillus and by a kind of *Dematium*.

As regards the manner in which acetic acid, for instance, is utilised, it is supposed that it is oxidised with formation of formaldehyde, carbonic anhydride, and water; this would explain the favourable effect of the CH·OH-groups or the isomeric formaldehyde. In the case of the utilisation of formic acid (sodium salt), there would probably be first a transformation into glyoxylic acid, and then decomposition of this into formaldehyde and carbonic anhydride. Oxalic and parabanic acids and urea, &c., cannot be used as sources of carbon, because they cannot furnish formaldehyde. There is at present no explanation for the difference in the value of the stereoisomeric, maleïc, and fumaric acids. As a rule, compounds containing the groups CH_3, CH_2, CH·OH, and $CH_2 \cdot OH$ can be used as sources of carbon, if not poisonous, and if not too resistant to the attacks of bacteria. In the following lists (next page) the various compounds are grouped thus: I, very good sources of carbon; II, moderately good; III, very poor; and IV, useless, so far as observed:—

The very remarkable observation of Hüppe (*Biol. Centr.*, **7**, 702), that the nitrifying bacteria will develop in inorganic solutions may be explained by assuming part of the hydrogen of the ammonia to act on carbonic anhydride to form formaldehyde and water, and the subsequent condensation of the formaldehyde to sugar.

Substances which support the life of aërobic bacteria are generally, but not always, suitable for mould-fungi. Compounds differ considerably in their power of developing fungi, for whilst isobutylic alcohol yields 9—10 per cent. of fungoid matter, asparagine yields nearly 22 per cent. Maleïc, citraconic, mesaconic, dibenzylmalonic, and diethylsuccinic acids cannot be utilised by moulds, whilst malonic, succinic, and methyl- and ethyl-succinic acids are well utilised. With regard to nitrogen, potassium ferrocyanide is not a very suitable compound, whilst hydroxylamine and diamide are poisons; azoimide can only be used highly diluted. The nitrogen compounds have always to be transformed into ammonia before proteïn formation can begin; anaërobic microbes effect this by reduction, aërobic by oxidation. In the assimilation of elementary nitrogen by microbes, ammonium nitrite is probably first formed, and the nitrous acid rapidly reduced to ammonia.

I.	II.	III.	IV.
Glycerol.	Methylic alcohol.	Phenol.	Pinacone.
Mannitol.	Ethylenic glycol.	Acetoxime.	Sulphonal.
Sugars.	Acetone.	Diacetoneamine.	Amidoacetal.
Lactic acid.	Acetic acid.	Valeric acid.	Oxalic acid.
Succinic acid.	Fumaric acid.	Maleic acid.	Meconic acid.
Tartaric acid.	Pyruvic acid.	Citraconic acid.	Picric acid.
Citric acid.	Levulinic acid.	Benzoic acid.	Antipyrine.
Betaïne.	Glycocine.	Lecithin.	Dimethyloxy-*m*-diazine.
Alanine.	Methylamine.	Trimethylamine.	Ethylenediamine.
Leucine.	Choline.	Strychnine.	Pyridine.
Asparagine.	Allantoïn.	Hexamethyleneamine.	Urea.
Glutamine.	Caffeïne.	Amidobenzoic acid.	Parabanic acid.
Creatine.	Methylic cyanide.	Glyoxylic acid.	Guanidine.

Sulphur seems to be present in the proteïds of fungi, as in other proteïds, as ·SH. Sulphates have, therefore, to be reduced. Sulphonal, $CMe_2{:}SO_2Et_2$, is a suitable source of sulphur in presence of easily assimilable carbon, but not otherwise.

Chlorophyll Plants.—In the higher, as in the lower plants, it must be assumed, whatever compounds are utilised for their growth, that the carbon compounds are so broken up as to produce formaldehyde, and that the nitrogen must be liberated as ammonia. As regards the different forms of nitrogen produced by the decomposition of proteïds, asparagine, leucine, and tyrosine, phenylamidopropionic and amidovaleric acids, arginine and allantoïn have been found; urea has not been detected, but guanidine occurs in the shoots of *Vicia sativa*. Schulze's observation that whilst amido-acids formed during the first period of germination decrease in quantity, asparagine increases, is of very great importance; when sugar takes part in the formation of proteïds from asparagine, it furnishes the deficiency of carbon. Proteïds might be formed in the following manner:—By reduction in presence of glucose, asparagine might yield aspartic aldehyde, and the ammonia liberated would immediately, in presence of glucose, form another molecule of aspartic aldehyde; 3 mols. of this aldehyde ($C_4H_7NO_2$) may be supposed to condense with elimination of water (2 mols.), and yield an intermediate compound, ($C_{12}H_{17}N_3O_4$), 6 mols. of which, with hydrogen (6 mols.) and hydrogen sulphide (1 mol.), would yield albumin of the formula $C_{72}H_{112}N_{18}SO_{22}$, and water (2 mols.). Glucose would again be required for the reduction. On the assumption that the aldehyde and amido-groups are prevented from acting on each other, and that in the reduction the 12 aldehyde groups are converted into secondary alcoholic groups, CH·OH, the final product (active albumin) would be of extraordinary lability, containing 12 aldehyde and 18 amido-groups in 1 mol. With the loss of its aldehyde character it would be changed to passive albumin. It is obvious that passive albumin is not produced by direct synthesis, but is the product of the transformation of the directly formed active, unstable albumin. N. H. J. M.

Active Albumin as Reserve Material in Plants. By Oscar Loew (*Bull. Coll. Agri., Imp. Univ., Tokyo*, 1894, **2**, 23—33).—The author and Bokorny have shown the presence in plants of a proteïn substance, apparently in solution, which gives certain reactions, of which living protoplasm, owing to its great lability, is incapable, and which neither dead protoplasm nor the known soluble proteïds show. The substance has the rôle of a reserve material, being used up during the growth and multiplication of cells.

Many algæ and parts of higher plants show, under the influence of caffeïne (0·1—0·5 per cent.) or of antipyrine (0·5 per cent.), a number of minute, transparent, colourless globules, which gradually unite to form larger globules or droplets, at the same time losing their original motions; all the *Spirogyræ* are specially adapted for these observations. When the objects are placed in water, the globules disappear, as the caffeïne leaves the cells by osmosis, and the cells continue to live as before the treatment; if, however, the cells die during the treatment, or are killed by poisons, the droplets also change their properties, thus showing close chemical resemblance of the matter in the protoplasm and in the droplets, the latter becoming turbid, and losing their solubility. When spirogyra-threads, containing freshly formed droplets, are exposed to ether vapour, the cells are killed in a few seconds, and, in about 20 minutes, the globules lose their brightness and their solubility.

In the dissolved state, the substance is quickly changed by the death of the cells in which caffeïne never produces globules. *Spirogyra Weberi*, treated for one minute with very dilute aqueous iodine, yields globules with caffeïne, but not after 10 minutes' treatment with iodine.

The substance is, therefore, a proteïd differing from ordinary soluble proteïds by being separated in globules by caffeïne, &c., and by its very great lability. In the coagulated state, the globules show all the properties of ordinary coagulated proteïds. When the proteosomes, as these globules are termed, are treated with ammonia they are solidified, the ammonia entering into intimate combination. This fixation of ammonia, which recalls the formation of pyrrolines from 1 : 4 ketones, is explained by the presence of aldehyde groups in the proteosomes, which are able to reduce silver nitrate, even after treatment with ammonia; the reaction with silver nitrate was also obtained with the proteosomes of *Symphorocarpus racemosus*, which is free from tannin, and from which every trace of sugar was removed.

The fact that proteosomes represent the active albumin was proved by cultivating Spirogyra in nutritive solutions without and with nitrogen (potassium nitrate). In the first case, the stored-up albumin was used up so thoroughly that, after two or three weeks, caffeïne failed to produce proteosomes; whilst in the second case, there was an intense formation of proteosomes with caffeïne after three weeks, more active albumin having been produced than was required. Changes of temperature have great influence on the amount of active albumin present, and phosphates interfere with its accumulation (Loew, "Physiol. Functions of Phosphoric acid," *Biol. Centr.*, **2**, 280).

Active albumin was found in a great variety of plants and in various parts of plants, but not in animals.

The separation of globules by caffeïne or antipyrine is probably due to a very loose combination in which the original chemical nature of the albumin is not otherwise altered, but it is also possible that the bases effect a loose kind of polymerisation; at any rate the original state may be restored by washing out the bases with water. Stronger bases (guanidine, methylamine, &c.) produce granules which do not form droplets, and which soon became insoluble in water; inorganic bases produce minute granules and rapid death of the cells (compare Loew and Bokorny, *D. chem. Kraftquelle im lebenden Protoplasma*, München, 1889; *Bot. Centr.*, 1889 and 1893; *Flora*, 1892, 127; Bokorny, *Prings. Jahrb.*, **19** and **20**; *Pflüger's Archiv*, **45** and **50**).

N. H. J. M.

Function of Diastase in Plants. By J. Grüss (*J. Pharm.*, 1895, [6], **2**, 275—276; from *Apoth. Zeit.*, 1895, 307).—Diastase may be readily detected in the cells of plants by digesting the tissue, for a sufficient length of time, with a solution of guaiacum in absolute alcohol, and then immersing sections of it in a dilute solution of hydrogen peroxide; a fine blue colour is developed in those cells which contain the enzyme.

The author finds that diastase is always present in those parts of the plant from which it is necessary that starch should be removed for purposes of nutrition.

As the amylolytic power of diastase is inhibited by the presence of more than a certain limiting amount of glucose, it would seem that in assimilation, the formation of glucose precedes that of starch, and continues as long as the sugar is removed by circulation. When, however, the sugar commences to accumulate beyond the requirements of the organism, it undergoes polymerisation to maltose and eventually to starch, which, in the presence of glucose, is not hydrolysed by the diastase; as soon, however, as the glucose is reduced by circulation below the inhibitory proportion, the starch is hydrolysed by the diastase, and the supply of soluble nutritive material thus maintained.

The amylolytic power of diastase is increased in presence of salts of the alkalis and alkaline earths, and by asparagine, &c.

Jn. W.

Hydrogen Peroxide in Plants. By J. Cho (*Bull. Coll. of Agric., Imp. Univ., Tokyo*, 1895, **2**, 225—227).—A reply to Bach (Abstr., 1895, ii, 239). Twenty-one species of plants were treated as described by Bach. In nine cases, a coloration was observed, but not the colour produced in the control experiment; moreover, the extracts gave the same reaction after treatment with platinum black, which would have destroyed any hydrogen peroxide, if it had been present. The coloration observed is probably only obtained when the leaves have been partly killed by the oxalic acid solution, so that certain readily oxidisable compounds are enabled to leave the cells by osmosis, and yield coloured products by oxidation in presence of aniline oxalate.

N. H. J. M.

Occurrence of two kinds of Mannan in the Roots of Conophallus Konyaku. By Y. Kinoshita (*Bull. Coll. Agric., Imp. Univ., Tokyo*, 1895, **2**, 205—206).—It was shown by Tsuji (this vol., ii, 44) that the root of *Conophallus* contains a large amount of an anhydride of mannose; it is now shown that two kinds of mannan are present. The finely ground root was repeatedly extracted with boiling water until the extract was no longer slimy. The residue yielded mannose when boiled with dilute acid, and the slimy extract, on the addition of alcohol, yielded a copious, nearly white, flocculent precipitate; the latter, when dried at 100°, was no longer soluble in water, but yielded mannose when boiled for some hours with 4 per cent. sulphuric acid. This mannan differs from that obtained from yeast by Salkowski (Abstr., 1894, i, 222) in losing its solubility on drying, but agrees in its behaviour with basic lead acetate (no precipitate), ferric chloride, and ammonia (gelatinous precipitate), copper sulphate and sodium hydroxide (thick, blue precipitate), and also with Fehling's solution.

The slimy mannan was not altered by the diastase of malt, by invertase, or emulsin, and Osawa's experiments on dogs showed that it is digested with much more difficulty than starch. An enzyme capable of saccharifying the mannan must, however, exist in the *konyaku* root, and the author hopes to isolate it. N. H. J. M.

Composition of some Mucilages. By K. Yoshimura (*Bull. Coll. Agric., Imp. Univ., Tokyo*, 1895, **2**, 207—208).—The slimy extracts of the various plants were concentrated, precipitated with alcohol, the washed precipitates boiled with sulphuric acid (2—4 per cent.), neutralised with barium chloride, filtered, and concentrated to syrups. Portions of these were evaporated with nitric acid and examined for mucic acid, other portions were mixed with phenylhydrazine acetate, whilst others again were examined with phloroglucinol and hydrochloric acid for pentoses. Finally, the osazones were prepared.

The mucilage of *Sterculia plantanifolia* (young shoots) consists of araban with some galactan; that of *Colocasia antiquorum* (tuberous roots) probably consists only of a polyanhydride of diglucose. The mucilages of *Vitis pentaphylla* (stems and leaves), and *Opuntia* (fleshy stems), chiefly consist of galactan, those of *Œnothera Jaquinii* (stems and leaves), and *Kadzura japonica* (young leaves and stems), contain galactan and araban. N. H. J. M.

Laccase in Vegetables. By GABRIEL BERTRAND (*Compt. rend.*, 1895, **121**, 166—168).—An alcoholic solution of gum guaiacum becomes blue in presence of air and a very small quantity of laccase; if the proportion of the latter is considerable, the blue coloration may change to green and eventually to yellow. This reaction is very convenient as a test for laccase, and by means of it, combined in most cases with the actual isolation of the laccase, the author has recognised the presence of this substance in the roots of the beet, carrot, and turnip, the tubers of the dahlia, potato, and Jerusalem artichoke, the rhizome of balisier, apples, pears, chestnuts, quinces, lucern, clover, rye-grass, asparagus, and the flowers of the gardenia. As a rule, only those organs of the plant which are in a state of active development contain any notable proportion of laccase.

In dealing with roots, rhizomes, tubers, and parenchymatous fruits, the juice may be precipitated with alcohol immediately after its extraction, but, in the case of green organs, the juice should be saturated with chloroform and allowed to remain for 24 hours, when it will coagulate spontaneously, and only the filtered liquid is treated with alcohol. C. H. B.

Asparagine in the Roots of Nelumbo Nucifera. By Y. KINOSHITA (*Bull. Coll. Agric., Imp. Univ., Tokyo*, 1895, **2**, 203—204).—The root of *Nelumbo nucifera* is rich in starch, and is used in Japan, in the boiled condition, as food. The following analytical results were obtained by Kellner:—water, 85·84; the dry substance gave: crude proteïn, 7·75; fat, 1·44; fibre, 7·19; non-nitrogenous extract, starch, &c., 78·59; ash (free from carbon and carbonic anhydride), 5·03 per cent.

Asparagine has been detected in comparatively few roots; the roots of *Althœa* contain 2, of *Glycirrhiza* (Plisson), 0·8, of *Scorzonera* (Gorup), 0·6, and potatoes (Schulze), 3 per cent. The dry substance of *Nelumbo* yielded nearly 2 per cent. of asparagine.

N. H. J. M.

Occurrence of Cytisine in various Papilionaceæ. By PIETER C. PLUGGE (*Arch. Pharm.*, 1895, **233**, 430—441).—Cytisine is contained in the following Papilionaceæ:—(1) *Cytisus Laburnum*, L., (*Laburnum vulgaris*, Grisebach); (2) *C. alpinus*, Mill; (3) *C. supinus*, Jacq.; (4) *C. elongatus*, W. u. K.; (5) *C. Weldinii*, Vis; (6) *C. sessifolius*, L.; (7) *C. hirsutus*, L.; (8) *C. biflorus*, L'her; (9) *C. Alschingeri*, Vis; (10) *C. nigricans*, L.; (11) *C. proliferus*, L., *fils*; (12) *Cytisus Adami*, Poit; (13) *C. ratisbonensis β-minor*, Schäf; (14) *C. ratisbonensis*, Schäf; (15) *C. polytrichus*, M. B.; (16) *Genista racemosus*, Marnoch; (17) *G. ramosissimus*, Ten; (18) *G. Spicatus;* (19) *Ulex europœus*, L. (Gerrard's Ulexine); (20) *Sophora speciosa;* (21) *S. tomentosa;* (22) *S. secundiflora*, Lagasca; (23) *Baptisia tinctoria* (v. Schroeder's baptitoxime); (24) *B. Australis;* (25) *Euchresta Horsfieldi*, Benn. The following members are free from cytisine:—(1) *Cytisus nigricans;* (2) *C. sessilifolius*, L.; (3) *C. argenteus*, L.; (4) *C. capitatus*, Jacq.; (5) *Genista tinctoria*, L.; (6) *G. pilosa*, L.; (7) *G. anglica*, L.; (8) *G. germanica;* (9) *Sophora japonica*, Dc.; (10) *S. japonica pendula;* (11) *Sophora affinis.* The author has investigated Nos. 20—25 in the first class, and Nos. 9—11 in the second. *Sophora speciosa* contains cytisine to the extent of 3·23 per cent., and as the infusion of the seeds is identical with cytisine in physiological action, the presence of a second alkaloïd is improbable. These results confirm the author's previous statement that Wood's "sophorine" and cytisine are identical. *S. secundiflora*, Lagasca (*Virgilia secundiflora*, Cad.), also contains in its seeds 3·47 per cent. of cytisine. The alkaloïd in the seed of *Euchresta Horsfieldii*, Benn, was identified by means of its colour reactions and the analysis of its auro- and platinochlorides, as cytisine. Cytisine gives, in addition to the reactions already known, a violet-red coloration with concentrated sulphuric acid and potassium permanganate, the intensity of the violet tint gradually increasing. J. B. T.

Composition of Pure Fruit Juices. By H. Kremla (*Bied. Centr.*, 1895, **24**, 498; from *Zeit. f. Nahrungsmittelhygiene u. Warenkunde*, **7**, 365—370).—The juices of the following fruits were analysed: (1) cherry; (2) currant; (3) gooseberry; (4) cranberry; (5) cider apple; and (6) melon. The results are given in grams per litre of juice. The acid is calculated as malic acid, and the sugar (reducing) as invert sugar.

	Balling's extract.	Acid.	Sugar.	Nitrogen.	Ash.
1	166·0—266·8	3·13— 7·23	100·6—172·6	—	—
2	103·0—167·1	21·2 —23·8	48·5—86·8	0·248—0·711	3·56—7·58
3	91·1	13·1	59·7	0·098	2·68
4	119·0	22·7	74·5	—	2·44
5	169·5	11·07	104·1	—	—
6	99·5	1·73	41·4	—	—

	K_2O.	CaO.	MgO.	P_2O_5.
2	2·128—2·549	0·206—1·230	0·106	0·229—0·501
4	1·192	0·270	0·126	0·099

The sp. gr. were as follows: (1) 1·0639—1·1023; (2) 1·0400—1·0644; (3) 1·0355; (4) 1·0462; (5) 1·0653; (6) 1·0387. Black cherries gave much more sugar and extract than red ones. Benzoic acid was found in cranberry juice. N. H. J. M.

Bark and Leaves of Drimys Granatensis, L. By Oswald Hesse (*Annalen*, 1895, **286**, 369—376).—The statement that the bark of *Drimys Granatensis* contains cotoïn has led the author to submit it to examination, the leaves having been included in the investigation, the result of which shows that cotoïn is not present in either bark or leaves. Three new substances have been isolated, drimin, drimyssic acid, and drimol.

Drimin, $C_{13}H_{14}O_4$, is obtained from the pulverised bark, which is extracted with ether, the ethereal solution evaporated, and the residue extracted with boiling petroleum; the insoluble portion is then dissolved in ether, and light petroleum added, when an oil is thrown down. On evaporating the solution and dissolving the residue in alcohol, ether precipitates drimin, which separates from alcohol as a micro-crystalline powder of pale brown colour; it melts at 256°.

Drimyssic acid has not been characterised; it was obtained from the liquid filtered from drimin, and has the properties of an acid.

Drimol, $C_{28}H_{58}O_2$, is obtained from the leaves by extracting with ether, evaporating the solvent, and dissolving the residue in alcohol; it crystallises from alcohol in small, white needles, and melts at 73—74°. The *acetyl* derivative, $C_{28}H_{57}AcO_2$, crystallises in small, white leaflets, and melts at 42—43°. The action of hydriodic acid (sp. gr. = 1·7) gives rise to the *iodide*, $C_{28}H_{57}IO$, which crystallises from hot glacial acetic acid in small needles; by the action of alcoholic potash, drimol is regenerated. M. O. F.

Amount of Fat, Sugar and Tannin in Coffee. By E. HERFELDT and ALBERT STUTZER (*Zeit. angw. Chem.*, 1895, 469—471).—The fat, or rather the ethereal extract, of coffee seems to be much increased by the roasting process; a sample of Santos coffee gave on analysis 10·86 per cent. of water and 8·15 per cent. of fat, whilst after roasting it yielded 2·43 per cent. of water and 16·58 per cent. of fat. New Granada coffee showed 10·45 of water and 13·10 per cent. of fat; after roasting, 2·18 per cent. of water and 15·44 per cent. of fat. Java coffee, however, showed a large decrease in fat, its moisture and fat being respectively 10·05 and 14·00 per cent. before, but 2·96 and 11·30 per cent. after roasting. The iodine and saponification figures of the fat before or after roasting do not admit of any definite conclusions.

The authors have not been able to detect actually existing sugars, but a little may be formed by hydrolysis of the tannin under favourable conditions. As regards the caffetannic acid, the authors have not been able to get anything like trustworthy results by estimating the sugar formed on hydrolysis with tartaric acid; treatment with aqueous soda also failed. Experiments to isolate the tannin as a bromo-derivative also proved unsatisfactory. L. DE K.

Composition of Pachyma Cocos and Mylitia Lapidescens. By ERNST WINTERSTEIN (*Arch. Pharm.*, 1895, **233**, 398—409).—Two specimens of *Pachyma Cocos* gave the following analytical results:—Proteïn substances = 0·56—1·00; substances allied to chitin = 0·60—1·00; ethereal extract = 0·35—0·42; ash = 0·06—0·25; water = 16·86—12·09; *d*-glucose = 1·40—1·13; fungus-cellulose = 2·25—3·24; pachymose = 76·21—79·84 per cent. The ethereal extract probably consisted of cholesterol. Gummy matters are also present in small quantity. Pachymose is an anhydride of *d*-glucose similar to paradextran and paraisodextran; when hydrolysed it yields 97 per cent. of *d*-glucose. The low content of ash is noteworthy. *Mylitta lapidescens* is composed as follows:—Proteïn substances = 2·36; substances allied to chitin = 0·91; ethereal extract = 0·10; ash = 0·20; water = 4·56; fungus-cellulose = 2·80; saccharo-colloïdes = 88·98 per cent. No carbohydrate soluble in cold dilute alkali is present; after prolonged heating with alkali, a slimy substance was isolated, which is similar to Tollens's saccharo-colloïdes. Full details of the analytical methods are given. J. B. T.

Kola Nut. By G. Le Bon (*Exper. Stat. Record*, 1895, **7**, 148; from *U.S. Consular Rep.*, 1895, Apr., 537—540).—The fresh kola nut possesses remarkable stimulating powers, whilst the dried nuts do not. It contains caffeïne (2·35 per cent.), theobromine (0·023 per cent.), and a red glucoside (1·3 per cent.), which after mastication is largely transformed into caffeïne. Experiments with caffeïne and theobromine showed that when mixed in the proportions in which they occur in the nuts, their sustaining power is equal to that of the nuts; neither compound alone has so great a stimulating effect as the nuts. It is thought that the nuts are of extreme importance as a muscular stimulant. N. H. J. M.

Coco-nut Shells. By R. W. Tromp de Haas and Bernhard Tollens (*Annalen*, 1895, **286**, 303—306).—The hard, inner shells of coco-nuts were finely powdered and extracted successively with cold, dilute hydrochloric acid, cold dilute ammonia, boiling alcohol, and boiling ether. The dry powder was then heated for an hour on the water-bath with 10 parts of 4 per cent. sulphuric acid, and subsequently in a porcelain basin over the flame; the hot, filtered liquid was neutralised with calcium carbonate, and evaporated, yielding a syrup which was redissolved in alcohol. This solution deposited 8 grams of xylose, 110 grams of the powdered shells having been employed. The specific rotatory power of the sugar thus obtained was $[\alpha]_D = +64·8°$ seven minutes after solution, diminishing to $[\alpha]_D = +18·3°$ on the following day. The xylose obtained from coco-nut shells crystallises from alcohol in white needles, and is not associated with other sugars.

The portion of shell-powder which remained undissolved by the hydrolytic agent, was treated with a mixture of 10 parts of concentrated sulphuric acid and two parts of water. After 2½ days, the liquid was diluted with 5 litres of water, and boiled for five hours in a reflux apparatus, filtered, and neutralised with calcium carbonate. The alcoholic solution of the syrup obtained on evaporation did not give the reaction for pentoses, but yielded pure *d*-glucose, which had a specific rotatory power $[\alpha]_D = +50·8°$, after remaining in solution for a day. Twenty grams of the powder undissolved in the first operation yielded 0·5 gram of *d*-glucose. M. O. F.

Composition of some French and other Oats harvested in 1893. By Balland (*Compt. rend.*, 1895, **120**, 502—504).—Various samples of oats from known sources were examined in order to be able to identify the principal types offered in the French markets. The War Department excludes nearly all foreign oats from their stores.

As regards chemical composition, the grey or black oats of Beauce contained over 10 per cent. of proteïds, about 5 per cent. of fat, and 7·5 to 9 per cent. of cellulose; the composition of samples from Champagne, Picardie, Vosges (except cellulose over 9 per cent.), Sweden, and of white Norwegian oats was similar. Russian oats (grey or black) contained: proteïds 10, fat less than 4, and cellulose 11 per cent. United States oats: proteïds 10, fat 5 per cent. Algerian oats: proteïds less than 9·5, fat 5 per cent. White oats from St. Petersburg contained 14 per cent. of proteïds; other white Russian oats: proteïds over 10, fat 3—4 per cent., and an excess of cellulose. The weight of the grains per thousand, which varies very considerably, is given in most cases, and also the percentages of kernel. N. H. J. M.

Cuscuta Epithymum. By Gaston Barbey (*J. Pharm.*, 1895, [6], **2**, 107—112).—The common dodder is a parasitic plant of the order *Convolvulaceæ*, and is said to possess diuretic and laxative properties, and to be a specific for gout. The author has examined the extract from 2 kilos. of the plant. The aqueous extract is acid, and yields a precipitate with potassium hydrogen carbonate, from which a yellow, amorphous powder, cuscutin, is extracted by ether. It is also precipitated by dilute sulphuric acid, and the residual solution then reduces alkaline copper tartrate. The alcoholic extract of the residue from the aqueous extract, yields a further quantity of cuscutin. Resinous and fatty products were also isolated, together with a tannin and a small amount of a crystalline substance, having a faint odour of coumarin.

Cuscutin is insoluble in cold water, and only sparingly soluble in boiling water yielding a yellow solution, from which it is precipitated in the amorphous form on cooling; with concentrated sulphuric acid, it gives a reddish-brown solution, having a green fluorescence; it is also soluble in acetic acid without change of colour. With ferric chloride, the aqueous solution gives a characteristic and very delicate violet-grey turbidity, red by transmitted light. Cuscutin is very soluble in alkalis, giving yellow solutions, which dye silk and paper, and stain the skin. Cuscutin is hydrolysed by mineral acids yielding glucose, and a resinous substance, *cuscuretin*, and it is, therefore, a glucoside. No analytical data are furnished. Jn. W.

Preparation and Composition of Tofu. By M. Inouye (*Bull. Coll. Agric., Imp. Univ., Tokyo*, **2**, 209—215).—In order to make up the deficiency of proteïds in rice, the inland inhabitants of Japan utilise various leguminous seeds, especially the soja bean. Two products prepared from this bean, miso and natto, have already been described (Kellner, *Tokyo Bull.*, **1**, No. 6; and Yabe, Abstr., 1895, ii, 130). A third preparation of soja beans, tofu, is obtained by pulping the beans after soaking them for 12 hours in water, boiling with water (3 parts) for an hour and filtering through cloth; the liquid which resembles milk in appearance, and fresh malt in taste, has a neutral or slightly acid reaction, but after several days becomes strongly acid (lactic acid), when the separation of caseïn takes place. In manufacturing tofu, the fresh filtrate is treated with about 2 per cent. of concentrated sea-water, the flocculent precipitate slowly pressed, and cut into tablets; the product has the taste of milk caseïn. In the beans themselves, the caseïn is in a soluble form in combination with potassium or sodium, and is not coagulated by boiling, but is precipitated by the calcium and magnesium salts in the brine; when tofu is boiled with 1 per cent. aqueous disodium phosphate, the caseïn redissolves, yielding an opalescent solution, calcium phosphate being formed.

Tofu is sometimes subjected to the action of frost, when it contracts and loses a large amount of water; the product is called koridofu. The following numbers show the percentage composition of (1) the fresh milky liquid, (2) tofu (Kellner), (3) koridofu, and (4) yuba (prepared by evaporating the soja bean extract) :—

	Water.	Proteïds.	N-free extract.	Fat and licithin.	Cellulose.	Ash.
1	92·53	3·02	1·88	2·13	0·03	0·41
2	89·29	4·87	4·35	—	—	0·48
3	15·32	41·42	15·05	23·65	1·48	3·08
4	21·85	42·60	7·65	24·6	—	2·82

The milky extract left for two weeks contained 0·092 gram of lactic acid per 100 c.c. The dry tofu yielded 11·2 per cent. of lecithin.

According to Osawa, tofu is as readily digested as beef.

N. H. J. M.

Action of Lime and Magnesia on the soluble Phosphoric Acid of the Soil. By C. SCHREIBER (*Exper. Stat. Record*, 1895, **7**, 104, from *Rev. Agr. Louvain*, 1895, **4**, 66—69).—Two mixed manures one containing dicalcium phosphate, calcium sulphate and magnesium carbonate, the other sodium phosphate, and calcium and magnesium carbonates were applied to oats (to be followed by turnips) on sandy, humus and loamy soils. In each case, the first named mixture gave much higher results, the difference being most marked in the case of turnips; this seems to be due to the calcium and magnesium carbonates of the second mixture rendering the phosphoric acid of the sodium salt insoluble; the action would be more complete during the second crop. The results of experiments on humus soil confirmed the author's previous conclusions, that the phosphoric acid combined with the humus of peaty soils, which is readily soluble in alkaline ammonium citrate, is almost useless for vegetation. In some cases, humus acts on assimilable phosphoric acid in a manner analogous to calcium carbonate. N. H. J. M.

Assimilable Nitrogen and its Transformations in Arable Soil. By PAGNOUL (*Compt. rend.*, 1895, **120**, 812—815).—A number of experiments were made in which large cases were filled with soil, (60 kilos.), variously manured, some of which were exposed, others sheltered from rain; all the cases were kept free from vegetation. An examination of the soil showed that the organic nitrogen is first transformed into ammonia, next into nitrous acid and finally into nitric acid.

The loss of nitrogen from bare soil may be considerable during heavy rains, but is entirely stopped by vegetation, such as grass. The application in August of carbon bisulphide (10 c.c.) to soil (2 kilograms) manured with cake, entirely checked nitrification until the end of September, but by the 16th October, 0·017 per cent. of nitric nitrogen was found; in a similar experiment without carbon bisulphide there was considerable nitrification during September. The effect of carbon bisulphide was therefore not to destroy the nitrifying organism, but to paralyse it temporarily; ammonia was produced during this time in considerable quantity amounting to 0·027 per cent. by the 16th October. N. J. H. M.

Behaviour of Hippuric Acid in Soils. By K. Yoshimura (*Bull. Coll. Agric., Imp. Univ.*, **2**, 221—223; *Note* by Oscar Loew, 223—224).—Of the total nitrogen of cow's urine, about 10 per cent. is in the form of hippuric acid, of horse's urine, about 2 per cent. Experiments were made to ascertain the absorptive power of soils for hippuric acid. The soils, one consisting of volcanic ashes and loam, the other a clayey soil, were found to have no power of retaining either the free acid or its sodium salt.

Dilute solutions of sodium hippurate containing potassium phosphate and magnesium sulphate, are able to develop mould fungi and microbes.

Solutions of sodium hippurate infected with surface and sub-soils were decomposed, ammonia being liberated; the decomposition is more rapid under the influence of surface soil than of subsoil organisms; only in one experiment was there an indication of nitrous acid with Griess' reaction.

Loew points out that the absence of nitrification in solutions of sodium hippurate is in accordance with other similar observations. Sterilised solutions of ammonium formate and oxalate respectively (0·05 per cent.), with potassium phosphate and magnesium sulphate, were infected from a culture from garden soil; the formate yielded no nitrate, and the oxalate only a small amount, about one-tenth the quantity yielded by ammonium carbonate. Nitrificaton is nearly twice as quick in the dark as in daylight.

There exists a bacillus (*B. methylicus*) able to assimilate formates (*Centr. f. Bact.*, **12**, No. 14). N. H. J. M.

Effect of Carbon Bisulphide on exhausted or "sick," (fatigués) Soils. By C. Oberlin (*Exper. Stat. Record*, 1895, **7**, 88—89; from *Journ. Agr. Pract.*, 1895, **59**, 459—464, 499—503, 535—540).—In applying carbon bisulphide for grape phylloxera, holes, 50—60 cm. deep, are made in the soil by means of iron rods, carbon bisulphide (50—100 c.c.) poured in and the holes carefully plugged. The vines are generally removed, and other crops grown for six years. As compared with crops growing on soils not treated with carbon bisulphide, those grown on soil so treated, were in many cases decidedly superior, for example, oats, lucerne, hairy vetch and beans; lucerne was especially benefited; on soil not treated with bisulphide, the crop still failed after six years, parallel plots to which there had been an application yielding vigorous growth. N. H. J. M.

Saline Soil and Water from Persia. By KONRAD NATTERER (*Monatsh.*, 1895, **16**, 639—673).—The author gives an account of the composition and properties of the samples of soil and water brought from the steppes of south-west Persia by Otto Stapf. In most cases, the samples contained those salts which are present in sea-water and in somewhat the same proportion, and the author therefore concludes that the salt wastes have been formed by the evaporation of salt water which has been separated from the main body of the ocean by the raising of the level of the land in earlier geological times. G. T. M.

The Potash and Phosphoric Acid required by Cultivated Plants. By SMETS and C. SCHREIBER (*Exper. Stat. Record*, 1895, **7**, 107—108; from *Rev. Agr. Louvain*, 1895, **4**, 78—79).—The relative requirements of various plants for potash and phosphoric acid are as follows:—For potash: oats (native) 18, oats (Flanders) 23, potatoes 37, spring wheat 43, flax 56, mustard 70, turnips 80. For phosphoric acid: lupins 27, potatoes 50, mustard 53, spring wheat 60, oats (native) 64, flax 66, oats (Flanders), 75, turnips 85.

The results were furnished by 267 pot experiments.

N. H. J. M.

Value of Bone Phosphates. By ULBRICHT (*Bied. Centr.*, 1895, **24**, 478—479; from *D. agrik.-chem. Vers.-Stat., Dahme*, 3—8).—The effective value of a bone phosphate depends on the amount of available phosphoric acid in the soil. The results of experiments in which four kinds of soil were manured, partly with bone phosphates and partly with superphosphate, showed the following increase in dry produce, due to superphosphate, as compared with the yield after the application of bone phosphates. Increase on light soil 10, on soil poor in phosphates 25, on artificial soil made of quartz, sand, and kaolin, and free from phosphates, 294, and on soil exhausted by vegetation, 24 per cent. Bone meal may, under favourable conditions, have a considerable effect even when employed in the spring; but its action is much hindered by dry weather, especially if it is not sufficiently finely ground. N. H. J. M.

Citrate Solubility of Basic Slag as Expressing its Manurial Value. By PAUL WAGNER (*Bied. Centr.*, 1895, **24**, 480; from *Deut. landw. Presse*, 1894, 983—984).—There is no regularity in the relation of the percentage of free lime in basic slag and its citrate solubility, as is stated by Hoyermann (*Bied. Centr.*, **24**, 130). As regards Hoyermann's explanation of the increased citrate solubility of slags rich in lime after fusion with sand, the author is of opinion that the calcium silicate formed during the fusion forms a readily decomposable calcium silicate-phosphate with the calcium phosphate of the slag.

N. H. J. M.

Chlorine in Rain Water. By N. Passerini (*Ann. Agron.*, 1895, **21**, 399—400; from *Bol. Scuola. agron. Scandici*, 1893, 12—22).—The following average amounts of chlorine in parts per million were found.

	Spring.	Summer.	Autumn.	Winter.
1890........	5·1	7·0	6·5	8·3
1891........	3·4	4·5	3·6	3·2

The station is situated near Florence, all the wind coming from the sea except the north-west; the gauge is 75 kilom. from the west coast, and 107 kilom. from the Adriatic.

At Antignano, near Leghorn, the average amount of chlorine in the rain is 116 parts per million. N. H. J. M.

Losses of Nitrogen in Waters of Infiltration. By J. J. Theophile Schloesing (*Compt. rend.*, 1895, **120**, 526—530).—A number of samples of water were taken from French rivers at different points, and the nitric nitrogen determined. The samples were taken during the last prolonged frost, after the temperature had been considerably below zero for many weeks, during which the rivers could not have been fed by surface, but only by subterraneous, water; aquatic vegetation, which would otherwise take up nitrates from the rivers, was, it is thought, practically suspended for the time.

The results are given in parts per million.

Seine in Paris, Feb.	9th, 2·09 ;	13th, 2·31 ;	19th, 2·25 ;	23rd, 2·26.
,, in Montereau,	16th Feb., 1·99 ;	27th Feb., 2·08.		
,, in Charenton,	15th Feb., 2·55 ;	28th Feb., 2·75.		
Marne, Charenton,	14th Feb., 2·34 ;	28th Feb., 2·02.		
Yonne, Monteneau,	16th Feb., 2·21 ;	27th Feb., 2·52.		
Oise, Pontoise,	19th Feb., 2·78 ;	1st March, 2·43.		
Vanne,		4th March, 2·61.		
Dhuis,		8th March, 2·86.		
Avre,		7th March, 3·08.		

Bousingault determined nitrates in Seine water (Paris) in 1856–57, but obtained much lower results (*Agronomie*, **2**, 65).

The chief point of interest shown by the above results is the uniformity in the amount of nitrates at the different dates, notwithstanding that the amount of water was reduced, at the later dates, to at least half.

From the average amount of nitric nitrogen (2·42 per million) the total annual loss per hectare is calculated for the basin of the Seine from the supposed amount of drainage. If the drainage is one-sixth of the total rainfall (700 mm.), the loss per hectare of nitric nitrogen would be 2·8 kilos.; if one-fourth, 4·29 kilos.; and if one-third, 5·65 kilos. The loss would, however, be mainly from arable land, and not from woods, and meadows, &c. When calculated on arable land and vineyards alone, the loss (in the basin of the Seine) is found to be 4·2, 6·44, or 8·48 kilos. per hectare, according to the amount of drainage. The calculations, which are only provisional, indicate much less loss than was generally supposed to take place.

N. H. J. M.

Analytical Chemistry.

New Forms of Gas Burettes. By O. Bleier (*Ber.*, 1895, **28**, 2423—2427).—In order to avoid inaccuracy in measuring the original volume of gas taken, the burette is made to contain exactly 100 c.c. under the conditions of experiment. The burette is filled with water, and the gas introduced through a tap at the top by allowing the water to run out by a tap at the bottom of the burette. If the gas is readily soluble in water, it must be passed through the burette for a certain time, in no case more than 30 seconds, in order to saturate the moisture adhering to the walls. A. H.

Inertness of Oxidising and Reducing Agents in Analyses in the Wet Way. By Marcellin Berthelot (*Ann. Chim. Phys.*, 1895, [7], **4**, 429—432).—The author calls attention to the fact that in the titration of persulphuric acid with ferrous sulphate and sulphuric acid, a discoloration of the liquid often occurs, and the final point is difficult to detect. This leads to erroneous results, and the cause is, probably, that an intermediate compound of persulphuric acid with ferrous sulphate is formed; this has a most decided colour, is unstable, but is not instantaneously reduced. In cases of titration of persulphuric acid, it is, therefore, better to at once add an excess of ferrous sulphate, and then to titrate back again with permanganate.

Titrations of oxalic acid with potassium permanganate in similar manner, proceed very slowly in the cold, but, in order to complete the reduction quickly, it is merely necessary to add a trace of manganese sulphate. A similar observation has also been made by Engel (Abstr., 1892, 277). These results may be due to the temporary formation of a manganic salt, or to the union of permanganic acid with a manganese salt. J. J. S.

Estimation of Water in Commercial Ammonium Sulphate. By John Hughes (*Chem. News*, 1895, **72**, 6).—The author calls attention to the importance of always estimating the moisture, and also the free sulphuric acid. in the samples. The water should be estimated by drying at 100°, and this should be done first in the original sample, and then be repeated after the salt has been finely ground for the purpose of analysis, as the moisture lost during the preparation of the sample may occasionally amount to 1 per cent. The analytical results are afterwards calculated into the state of the sample as received. L. de K.

Detection of Chlorine, Bromine, and Iodine in Organic Compounds. By P. N. Raikow (*Chem. Zeit.*, 1895, **19**, 902—903). —A fragment of silver nitrate is for a moment gently heated with a little sulphuric acid in a test tube. After cooling, the substance to be tested is added, and the mixture is again gently heated. If iodine is present, part of it escapes, but some of it forms a yellow precipitate of silver iodide, which, however, gradually disappears on boiling.

Chlorine will be detected by a temporary white precipitate; bromine by a temporary pale yellow deposit. The process is applicable to all organic compounds containing haloïds. L. DE K.

Electrolytic Estimation of the Halogens. By GEORG VORTMANN (*Monatsh.*, 1895, **16**, 674—683).—The author has previously described a method for the electrolytic estimation of iodine (Abstr., 1894, ii, 426), and now calls attention to several important improvements in the process. An anode of pure silver, shaped like a clock-glass, a cathode of platinum or copper, and a current which does not exceed 2 volts in the case of cold solutions containing no alkali tartrate, or 1·3 volts when the solution is warm and contains alkali tartrates, are employed. The electrolysis is continued until the solution no longer gives the iodine reaction or until a new anode placed in the solution does not gain in weight. Under these conditions, no silver is dissolved from the anode, which retains on its surface the whole of the iodine in the form of silver iodide. G. T. M.

Estimation of Iodine in Organic Substances. By M. C. SCHUYTEN (*Chem. Zeit.*, 1895, **19**, 1143).—The author's method is applicable to members of the fatty series only. The substance is introduced into a 15-cm. test tube, and mixed with finely powdered, previously fused, potassium dichromate. After covering the mixture with another 5—6 cm. layer of the chromate, the tube is drawn out to a bent capillary. While the latter is kept cool with a wet piece of cloth, the contents of the tube are heated, commencing at the top, until no further sublimation of iodine takes place.

The tube is cut in two, the part containing the iodine is rinsed with a solution of potassium iodide, and the iodine is then titrated as usual; or the iodine may be weighed. In the latter case, the capillary part containing the iodine is connected with a calcium chloride tube containing also a few pieces of soda-lime; when a magnifying glass no longer shows the presence of water, the tube is weighed. After gently heating to volatilise the iodine, the glass is re-weighed. L. DE K.

Estimation of Sulphur in Pyrites. By ALEXANDER VON ASBÓTH (*Chem. Zeit.*, 1895, **19**, 598—599).—The author has investigated the processes recommended by Johnson (reduction of the ferric salt by means of sodium hypophosphite before precipitating with barium chloride), Hoehnel and Glaser (fusion with sodium carbonate and sodium peroxide), and Fresenius (fusion with sodium carbonate and potassium nitrate).

The second method is, in the author's opinion, the best, but it is necessary to evaporate the aqueous solution to dryness with addition of bromine and hydrochloric acid so as to ensure the complete oxidation of the sulphur and the removal of any silica. L. DE K.

Detection of Sulphates, Sulphites, and Thiosulphates in Presence of each other. By R. GREIG SMITH (*Chem. News*, 1895,

72, 39—40).—Excess of barium chloride and plenty of ammonium chloride are added to the solution, which is made dilute when thiosulphates are present; hydrochloric acid is then dropped in until barium sulphate alone remains undissolved. The filtered solution is next rendered permanently yellow with iodine, when a turbidity or precipitate indicates the presence of sulphite, which has been oxidised to sulphate, whilst any thiosulphate is converted into tetrathionate; this in its turn is oxidised to sulphate on adding bromine water to the clear solution. Hydrogen sulphide would interfere with these reactions, and is removed at the start by means of a current of carbonic anhydride. D. A. L.

Qualitative Analysis of a Mixture of Hydric Sulphide, Polysulphide, Thiosulphate, Sulphite, and Sulphate. By W. POPPLEWELL BLOXAM (*Chem. News*, 1895, **72**, 63—64).—The solution is precipitated with an ammoniacal solution of zinc, cadmium, and ammonium chlorides. The filtrate is divided into two portions; one of these is tested for sulphites and thiosulphates by Fresenius's process, which consists in neutralising part of the liquid with acetic acid and adding a trace of sodium nitroprusside and, if necessary, some potassium ferrocyanide, which gives a red coloration with sulphites. Thiosulphates are tested for by adding hydrochloric acid. The other half is tested for sulphates as follows. After adding a little sodium hydrogen carbonate, the liquid is placed in a flask fitted with a trebly perforated cork; through an inlet tube, a current of carbonic anhydride is admitted, and an outlet tube is provided dipping below the surface of water, whilst through the third hole, a small stoppered separating funnel is passed, the tube reaching nearly to the bottom of the flask. While the gas is passing, the liquid is gradually raised to boiling, and, after all the air is expelled, hydrochloric acid is slowly admitted through the funnel until it is in excess; the liquid is then boiled down to one-fifth of its original bulk, the current of carbonic anhydride still being maintained. After filtering off the separated sulphur, the liquid is tested for sulphates as usual. L. DE K.

Estimation of Organic Nitrogen by the Kjeldahl Process. By HENRI E. CAUSSE (*J. Pharm.*, 1895, [6], **1**, 543—549; compare Dyer, Trans., 1895, 811).—The ordinary modification of the Kjeldahl process yields satisfactory results with substances, such as guano, containing less than 5 per cent. of nitrogen, but with more highly nitrogenous substances, such as wool and leather, it gives results as much as 2 per cent. too low. The addition of mercuric oxide, recommended by the American Committee, is either unnecessary or objectionable, for, although the time required to effect the decolorisation of the liquid may be considerably diminished by using sufficient oxide, the clear product then contains unreduced nitrogen. A sample of dried wool, for instance, which yielded about 12·5 per cent. of nitrogen by the soda-lime method, and also by the American method when a small amount of the oxide (0·2—0·3 gram to 0·3—0·35 gram of wool) was used, gave only 10·5 per cent., or even less, when the amount of the oxide (2—4 grams) was such as to effect decolorisation in an hour.

Neither is the result improved by the addition of sodium sulphide to the alkaline liquid before distillation, and the deficiency is therefore not due to the retention of ammonia in mercuric combination; the addition of permanganate is equally inefficacious, as nitrogen ring compounds are stable towards that agent.

The author recommends the substitution of copper sulphate for the mercury or mercuric oxide. The substance (0·3—0·8 gram) is boiled in a round-bottomed flask with concentrated sulphuric acid (20 c.c.), and a small amount (0·3 gram) of the sulphate, until a clear solution is obtained; the operation requires about three hours, but does not need attention if the flask is surrounded by a metal jacket. The product is diluted (to 300 c.c.), rendered alkaline with caustic soda, and distilled into standard sulphuric acid in the usual way. The copper remains in the solution, which is at first blue, and finally colourless, provided the caustic soda is free from carbonate, but if carbonate is present copper is precipitated, and a portion of the ammonia retained.

The specimen analyses quoted agree well with duplicates made by the soda-lime method. JN. W.

Estimation of Phosphoric acid by the Molybdenum Method. By HUGO NEUBAUER (*Zeit. anorg. Chem.*, 1895, **10**, 60—65).—In the estimation of phosphoric acid by means of molybdic acid, the precipitate obtained is usually not more than 0·27 gram $Mg_2P_2O_7$. The author has determined the correction necessary to compensate for the volatilisation of phosphoric acid. With 0·07 gram $Mg_2P_2O_7$, the volatile $P_2O_5 = 0$; with 0·35 gram $Mg_2P_2O_7$ the volatile P_2O_5 calculated as $Mg_2P_2O_7 = 0{\cdot}006$ gram. Whence the following equation is obtained for the correction number x. When $n =$ the $Mg_2P_2O_7$ found in milligrams, $x = (n - 70) . 0{\cdot}021$.

The author recommends the use of a crucible lid coated with magnesium oxide to prevent loss of phosphoric acid, especially when larger quantities of phosphoric acid are being estimated. The following directions must be closely followed in order to obtain trustworthy results by the molybdic acid method. The yellow precipitate is dissolved in 100 c.c. of $2\frac{1}{2}$ per cent. ammonia. The precipitation with the magnesia mixture must be performed slowly, with stirring. When the volatile phosphoric anhydride is determined directly by means of a crucible lid coated with magnesia, the filter is burned at the lowest possible temperature, and the lid put on directly the temperature is raised, the precipitate being heated for one hour over a strong Terquem- or Teclu-burner, in such a way that the whole crucible is at a full red heat. Care must be taken to determine if the magnesia coated lid gains in weight under the influence of the burning gas. The author recommends a spirit burner instead of gas, especially when the gas contains any quantity of sulphur compounds.

E. C. R.

Analysis of Artificial Manures. By von Grueber (*Zeit. angw. Chem.*, 1895, 504—516).—An elaborate article, dealing with the practical analysis of manures in the way proposed by the society of German manure manufacturers. The methods present, on the whole, no novel features, but, by strictly adhering to them, analytical differences will, no doubt, be to a great extent obviated. L. de K.

Gravimetric Estimation of Arsenic. By Carl Friedheim and Paul Michaelis (*Zeit. anal. Chem.*, 1895, **34**, 505—545).—I. *The ammonium magnesium arsenate method.*—The authors, combining the most advantageous features of the proposals of Puller, Wood, Fresenius, and others, proceed as follows:—About 0·3 gram of arsenic acid in 100 c.c. is mixed with 10 c.c. of ammonia (sp. gr. 0·96), 20 c.c. of magnesia mixture (made from magnesium chloride), and about 45 c.c. of alcohol; after 48 hours, the precipitate is collected and washed with a mixture of 2 vols. alcohol, 1 vol. ammonia, and 3 vols. water until free from chlorine. The filtrate contains only unweighable traces of arsenic, so that Puller's correction of 1 milligram per 16 c.c. is not required. The use of the Gooch crucible, with a filter-bed of asbestos, is strongly recommended, since, with paper filters, a loss of arsenic is inevitable. The precipitate is ignited in oxygen, at first by a single burner, then by a multiple one for 15—30 minutes, until a constant weight is attained; the blowpipe should not be used, for, at the temperature which it gives, decomposition of the pyroarsenate and loss of arsenic occur, moreover, the crucible should stand in a small porcelain capsule to protect its contents from the flame. The precipitate undergoes partial decomposition when heated with water, hence attempts to ascertain its weight by rinsing it into a crucible and evaporating the water results in serious loss. Bunsen's method of dissolving in nitric acid and evaporating is also unsatisfactory, but experiments conducted as above did not in any case deviate more than 0·0007 gram of As_2O_3 from the amount taken.

II. *Estimation as Trisulphide.*—Here, also, the employment of the Gooch crucible avoids the inconveniences attending the use of dried paper filters. The chief difficulty in this process is the tendency of the precipitate to contain more sulphur than corresponds with the formula As_2S_3; part, at least, of this excess, is shown to exist in the form of arsenious hydrosulphide, which compound is not decomposed by expelling the dissolved hydrogen sulphide by a current of carbonic anhydride, and is only very slowly decomposed, with partial oxidation and separation of sulphur, when the precipitate is dried at 100—103°. Hence, all attempts to dissolve out the excess of sulphur by carbon disulphide, fail to remove it completely. For the same reason, also, the method of Classen and Ludwig (Abstr., 1885, 932) does not give correct results. Mohr's method of dissolving in ammonia and evaporating the solution is also untrustworthy, as, in consequence of the large surface exposed, oxidation of sulphur and loss of weight occur during the drying. Rose's method of oxidising the precipitate, determining the total sulphur as barium sulphate, and estimating the arsenic from the difference, seems to be free from sources of error. A customary method is to oxidise the precipitate by nitric acid and throw down the arsenic acid as ammonium magnesium arsenate, but the presence of the sulphuric acid resulting from the oxidation, entails the co-precipitation of some basic magnesium sulphate, and renders a double precipitation necessary. In this second precipitation, too much dilution must be avoided; 30 c.c. of solution for 0·1 gram of As_2O_5 is an appropriate proportion; a little magnesia mixture should be added, and ⅓ vol. of alcohol, or the precipitation will be incomplete. Bäckström has proposed (Abstr., 1893, ii, 299) to separate the sulphuric acid from the arsenic acid in the oxidised precipitate by simply heating until the former is expelled, but the authors show that however carefully the heat is applied, a loss of arsenic acid occurs before all the sulphuric acid is driven off.

Arsenious acid, intended for precipitation as sulphide, is best dissolved in potassium hydrogen carbonate, as its solution in an alkali hydroxide oxidises gradually to arsenate on exposure to air. Before precipitating, it must be acidified with a quarter to one-half its volume of hydrochloric acid of 1·12 sp. gr.; passing hydrogen sulphide for half an hour suffices for complete precipitation, but one hour is recommended. Subsequent expulsion of the dissolved hydrogen sulphide, either by warming or by carbonic anhydride, is neither necessary nor desirable, and since arsenious sulphide is not soluble in hydrogen sulphide water, moreover, the passage of carbonic anhydride does not diminish the excess of sulphur in the precipitate if filtration is commenced within 10 minutes of stopping the current of hydrogen sulphide, but, on the other hand, dissolves traces of arsenic from the precipitate, in consequence of the reaction $As_2S_3 + 3H_2O = As_2O_3 + 3H_2S$. One and a-half hours drying at 105—110° suffices to give a constant weight; in an atmosphere of carbonic anhydride, no loss of weight takes place at 140°. M. J. S.

Boric acid. By A. VILLIERS and M. FAYOLLE (*J. Pharm.*, 1895, [6], **2**, 241—244).—The ordinary tests for boric acid leave much to be desired. Those founded on the turmeric reaction are unsatisfactory, because the colour change is not sufficiently characteristic. Those based on the flame coloration, on the one hand, if applied directly to the solid substance, are liable to give misleading indications if copper be present, as is often the case in wine ash, and to be masked by the more intense colorations due to sodium, &c.; and, on the other hand, if applied to the alcoholic distillate, they are open to the objection that the delicacy of the test is very variable, the intensity of the coloration depending on the stage of the distillation at which it is observed, as well as on the amount of boric acid present.

In testing for boric acid in wines, the authors recommend the repeated distillation of the ash (from 25 c.c.) with small quantities of methylic alcohol (3 c.c., three times), after moistening it with concentrated sulphuric acid (1 c.c.). The whole of the boric acid passes over, and its amount may be estimated colorimetrically with fair accuracy, by comparison of the flame with those given by standard solutions of the acid. Quantities from 0·5 to 0·1 milligram may be detected in this way.

A number of natural wines which were examined by this process

did not contain a trace of boric acid. The marked quantities found by other authors must, therefore, either be attributed to the presence of copper, or to the introduction of boric acid in fining the wines.
JN. W.

Estimation of Boric acid. By HENRI JAY and DUPASQUIER (*Compt. rend.*, 1895, **121**, 260—262).—In order to estimate boric acid by converting it into methylic borate, the substance is very slightly acidified with hydrochloric or sulphuric acid, mixed with 25 to 30 c.c. of methylic alcohol, and placed in a flask, which is connected with another flask containing a normal alkali hydroxide solution free from carbonates, and also with a condenser, in such a way that the methylic borate formed in the first flask passes through the alkali solution in the second flask, whilst the methylic alcohol, which is again set free, is condensed, and falls back into the first flask. After boiling for about an hour and a half, the alkali solution is heated to expel methylic alcohol, very slightly acidified with dilute hydrochloric acid, again heated to expel carbonic anhydride, and titrated with decinormal alkali until neutral to litmus paper. Two drops of an aqueous solution of the blue C.4.B. are added, and the addition of alkali is continued until the first colour-change begins. The second quantity of alkali, less 0·2 to 0·3 c.c., according to the volume of the liquid, gives the quantity of boric acid present. In order to obtain accurate results, the temperature and volume of the liquid operated on must be constant, and methylic alcohol and carbonic anhydride must be expelled.

Pure wines contain from 0·0105 to 0·022 gram of boric anhydride per litre; cider and perry 0·011 to 0·017; urine, 0·008 to 0·017. The acid was not found in the bone or flesh of an ox. The accuracy of the estimation is slightly affected by the presence of fluorides, but not by that of other salts.
C. H. B.

Estimation of Carbonic Oxide in Air. By JOHN S. HALDANE (*J. Physiol.*, 1895, **18**, 463—469).—The method described depends on the fact that when a hæmoglobin solution is shaken with air containing carbonic oxide, the proportion of the pigment which finally combines with the gas varies with the percentage of carbonic oxide in the air. This proportion is determined by a colorimetric method, standard carmine solution being added to a standard solution of diluted blood till it becomes as pink as that which has been shaken with the air containing the poisonous gas. The details of the method, which yields delicate rather than accurate results, are described in full.
W. D. H.

Gold and Silver in Copper and Copper Matte. By ERNEST A. SMITH (*Chem. News*, 1895, **72**, 76—77).—Commenting on the discrepancies that often occur in the results obtained by different assayers working on the same sample, it is suggested that neglect to take notice of the silver in the test-lead, use of one acid only, and that probably strong, for parting, and bad balances are the most frequent causes of the differences alluded to.
D. A. L.

Detection and Estimation of Mercury in Urine. By Adolf Jolles (*Monatsh.*, 1895, **16**, 684—692).—From 100 to 300 c.c. of urine, according to the amount of mercury supposed to be present, is treated with stannous chloride and free hydrochloric acid in presence of about 2 grams of granular gold. The precipitated mercury amalgamates with the gold, which is afterwards washed by decantation and treated with hot concentrated nitric acid, whereby the mercury is dissolved. The solution thus obtained is diluted with water, and, on the addition of stannous chloride, yields a precipitate even when only a minute trace of mercury is present.

To determine the mercury quantitatively, the amalgam of gold obtained as above is washed with water, alcohol, and ether, weighed in a hard glass tube, and the mercury distilled off. The loss in weight gives directly the amount of mercury present.

G. T. M.

Volumetric Estimation of Platinochlorides; Estimation of Potassium, Ammonium, Nitrogen, and Platinum. By Lucien L. de Koninck (*Chem. Zeit.*, 1895, **19**, 901—902).—The platinochlorides of potassium or ammonium obtained during an analysis, may, instead of being weighed, be volumetrically treated by applying the reduction principle of Correnwinder and Contamina. The precipitate is dissolved in boiling water and heated for some time with calcium formate, which soon removes the platinum, leaving potassium or ammonium and calcium chlorides, also free hydrochloric acid in solution.

The mixture is neutralised by means of calcium carbonate suspended in water, and, after filtering, the chlorine is estimated as usual by means of silver nitrate. Six atoms of chlorine represent 2 atoms of potassium, ammonium, or nitrogen, and 1 atom of platinum. The calcium carbonate is made from calcium nitrate and sodium carbonate. L. de K.

Quantitative Separation of Benzene from Light Petroleum. By Robert Henriques (*Chem. Zeit.*, 1895, **18**, 958—959).—5—7 c.c. of the mixture is introduced into a 25-c.c. glass stoppered cylinder, divided to 0·2 c.c., and shaken with twice its volume of sulphuric acid containing 5 per cent. of added sulphuric anhydride, until nothing more is dissolved.

The benzenes soon become sulphonated and dissolve, whilst the light petroleum is scarcely attacked, and floats on the surface of the acid; its volume may then be read off. L. de K.

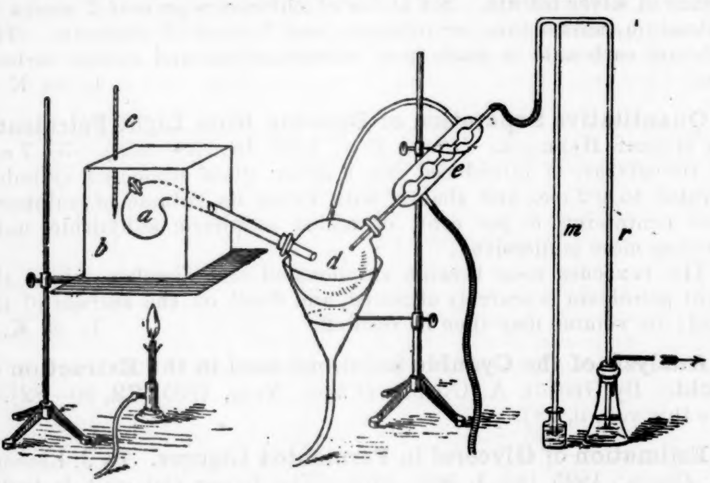
Analysis of the Cyanide Solutions used in the Extraction of Gold. By George A. Goyder (*Chem. News*, 1895, **72**, 80—82).—See this vol., ii, 28).

Estimation of Glycerol in Fermented Liquors. By J. Laborde (*J. Pharm.*, 1895, [6], **1**, 568—570).—The liquor (50 c.c.) is boiled nearly to dryness (1 c.c.) in a flask containing a quantity of lead shot (100 grams). The glycerol, which is retained in combination with the acid of the wine, is liberated from the residue by the addition of finely powdered, slaked lime, with which it is incorporated into a stiff paste by agitation with the shot. If sugar is present, the lime is previously moistened with alcohol, and a larger quantity is used. The liberated glycerol is extracted from the paste by repeatedly shaking with alcohol-ether, and the extract having been acidified with sulphuric acid (10—15 drops), the solvent is as far as possible distilled off, and the residual alcohol removed by repeatedly boiling with water; the acid aqueous solution thus obtained is evaporated to dryness and carbonised, and the amount of glycerol calculated from that of the carbon obtained.

Trial analyses of wine and beer, to which various amounts of glycerol were added, are stated to have been satisfactory.

The ratio of alcohol to glycerol in red wines appears to vary within the limits 1 : 10 and 1 : 16. JN. W.

Estimation of Glycerol in Wine and Beer. By ALFRED PARTHEIL (*Arch. Pharm.*, 1895, **233**, 391—398).—The liquid under examination (50 c.c.) is mixed with calcium carbonate and concentrated to 10—15 c.c.; it is then filtered into a tubulated retort, *a*, of 100 c.c. capacity, fitted at the tubulus with a bored cork, which is closed with a glass rod; the retort is heated in an air bath, *b*, the bottom being of sheet iron, the sides and top of asbestos paper, fastened by means of water-glass. The bath is heated at 120°, and when the contents of the retort have been distilled almost to dryness, the bath is cooled to 60°, the apparatus exhausted, and the distillation continued at 180° (25—30 mm.); this requires 1·5 hours. The apparatus is allowed to cool, the pressure restored, water (10 c.c.) added to the retort, and the distillation repeated at 120°. All the glycerol will be found in the receiver, *d*; should it be coloured, it must be distilled again under similar conditions. The glycerol is determined by Baumert and Schaumann's method (Abstr., 1892, 1529). The contents of the receiver and condenser, *e*, are washed into an Erlenmeyer



flask, diluted to about 200 c.c., sodium hydroxide (8—10 grams) added, and then potassium permanganate solution (5 per cent.), until the liquid remains bluish-black; it is next heated on the water bath for an hour, decolorised by means of sulphurous anhydride, acidified with glacial acetic acid (20 c.c.), and evaporated until free from sulphurous anhydride. The residue is diluted to about 200 c.c., and calcium chloride added in excess, the mixed precipitate of calcium oxalate and calcium sulphate being collected on an asbestos filter, and washed until the liquid ceases to affect potassium permanganate solution; it is then dissolved in dilute sulphuric acid, and the oxalic acid estimated in the usual manner by means of standard potassium permanganate solution (about 5 : 1000). Under the above conditions, 1 mol. glycerol yields 1 mol. oxalic acid, and the analyses given of wine, beer, and aqueous glycerol solutions agree closely with the theoretical.

In the sketch, *m* is the manometer, and *r* a tube and valve to prevent the back flow of water from the pump. If the pressure in the apparatus is reduced without previously cooling, in the manner described by von Törring, loss of glycerol always occurs.

J. B. T.

Estimation of Pentoses and Pentosans in Diffusion Cuttings, Sugar Beet, and some Food Stuffs. By A. STIFT (*Chem. Centr.*, 1895, i, 448—449; from *Österr.-ung. Zeit. Zucker-Ind.*, **23**, 925—933).—The substance under examination (2·5—5·0 grams), together with hydrochloric acid, sp. gr. = 1·06 (100 c.c.), is placed in a flask (300 c.c. capacity), which is fitted with a funnel and heated by means of a bath of fusible metal; after distilling during 10—12 minutes, when 30 c.c. should have passed over, hydrochloric acid (30 c.c.) is added, the distillation continued, and these operations repeated until the production of furfuraldehyde ceases. The distillate is treated exactly in the manner described by Tollens. The whole analysis requires 5½—6 hours; it presents no special difficulties, and affords valuable information as to the relative worth of the most varied food stuffs. J. B. T.

Relative Proportion of Glucose and Levulose in Sweet Wines. By F. JOSEF KÖNIG (*Chem. Zeit.*, 1895, **19**, 999—1000).—The relative proportion of glucose and levulose in sweet wines may be calculated from the copper-reducing power, coupled with a polarimetric observation. The colouring and tannin matters are best removed by means of basic lead acetate, as the use of animal charcoal causes a slight loss of sugar.

If there is a large excess of levulose present, it may be concluded that the wine has been prepared by fermenting a concentrated juice, and then suddenly stopping the fermentation by adding alcohol or by other means; whilst, if the dextrose is largely in excess, its wilful addition may be suspected. If both are present in about equal amounts, with perhaps a slight excess of levulose, no particular conclusion can be drawn; the relation of the dextrose to the levulose will not decide the question whether the grape-juice has, from the commencement, been fortified with cane or starch sugar. On the whole the analysis of sweet wines is still in a somewhat unsatisfactory condition. L. DE K.

Estimation of Glycogen in Liver and Muscle. By WLADIMIR A. KISTIAKOFFSKY (*Chem. Centr.*, 1895, i, 449; from *Pharm. Zeit. Russ.*, **34**, 25).—The use of 0·1—0·3 per cent. solutions of alkali instead of 2 per cent., for the extraction of glycogen, is recommended by Brücke; but glycogen may also be obtained by extracting the finely divided substance 5—6 times with boiling water, and pressing the residue. In addition to the glycogen, the liquid contains alkali albuminates, glutin, and traces of peptone; these are removed by precipitation with potassiomercuric iodide after the liquid has been concentrated and acidified with hydrochloric acid; the glycogen is precipitated from the filtrate by means of alcohol (compare Huizinga, this vol., i, 6).

J. B. T.

Estimation of Glycogen. Detection of Albumoses in Presence of Glycogen. By D. HUIZINGA (*Pflüger's Archiv*, 1895, **61**, 32—38).—See this vol., i, 6.

Estimation of Formic acid. By FRANZ FREYER (*Chem. Zeit.*, 1895, **19**, 1184—1185).—The author's process has been invented for the purpose of estimating calcium formate in the presence of acetate. The mixture having been distilled with dilute sulphuric acid in a current of steam until the distillate is no longer acid, the total acidity is estimated in an aliquot part of the distillate by means of standard soda, and another portion of the liquid is neutralised with aqueous soda and concentrated to a small bulk. It is then boiled with a mixture of dilute sulphuric acid and potassium dichromate, which is without any action on the acetic acid, but rapidly and completely oxidises the formic acid to carbonic anhydride and water. The strength of the dichromate must, of course, be accurately known, and the excess is afterwards determined as usual by means of potassium iodide and sodium thiosulphate. To better see the change in colour, a little metaphosphoric acid may be added. L. DE K.

The Resorcinol Test for Tartaric acid. By GEORGES DENIGÈS (*J. Pharm.*, 1895, [6], **1**, 586—589; compare Mohler, Abstr., 1891, 867).—Mohler's test, which consists in the addition of the substance to be tested to a dilute solution of resorcinol in concentrated sulphuric acid at 120°, with the consequent production, if a tartrate is present, of a violet coloration, is open to the objections that the reagent is perishable, that the test is applicable only to solid substances, thus necessitating the evaporation of solutions to dryness, and that the violet coloration, or one closely resembling it, is produced by various oxidising agents. The author has modified the process in a manner to obviate these defects.

A solution of pure, white resorcinol (2 grams) in very dilute sulphuric acid ($\frac{1}{2}$ c.c. to 100 c.c. water) is quite stable, and, by adding a portion of this to about 20 vols. of concentrated acid at the time of testing (2 or 3 drops to 2 c.c.), a solution is obtained equivalent to Mohler's reagent. A small quantity of the liquid to be tested (1 or 2 drops) is added to the reagent, and the mixture gradually warmed to 115°—140°, when, if tartaric acid is present, the characteristic violet-red colour is developed. It is due to the presence of a broad absorption band in the spectrum, extending from $\lambda = 510$ to $\lambda = 545$, and best seen with solutions diluted with concentrated sulphuric or acetic acids.

If the coloration appears before heating, it is due to the presence of an oxidising agent in the liquid, and this must be previously removed by reduction with copper-zinc and dilute sulphuric acid (5 c.c. of solution to be tested, 5—6 drops copper sulphate solution, 2 grams of zinc, and 1 c.c. of acid). Tartaric acid can in this way be detected in a few drops of a 1 per cent. solution containing, in addition, 10 per cent. each of sodium nitrite, and potassium nitrate, chromate, and chlorate.

Substances such as cane sugar, which are blackened by sulphuric acid, are best eliminated by Mohler's method of precipitating the acid as lead salt, and washing the latter with dilute nitric acid before decomposing it and making the test. JN. W.

Analysis of Fish Oils. By VIKTOR VEDRÖDI (*Chem. Zeit.*, 1895, **19**, 600—601).—The author calls attention to the enormous difference in composition of various commercial brands of fish oil, particularly as regards their acidity and percentage of unsaponifiable matter. The acidity was found to vary from 0·74 to 38·9 per cent., and the unsaponifiable matter from 0·6 to 82 per cent.

No sample should be used for tanning purposes unless the acidity and the unsaponifiable matter do not exceed 15 and 4 per cent. respectively. L. DE K.

Examination of Fats by Means of the Refractometer. By HEINRICH BECKURTS and H. HEILER (*Arch. Pharm.*, 1895, **233**, 423—428).—The objects of this investigation were the determination (1) of the influence of temperature on the refractive power of various fats and oils, and (2) the relationship, if any, between the refractive power, the percentage of volatile acids, and the iodine additive capacity; the experiments were conducted with a Zeiss' refractometer. The increase in the refractive power in scale divisions, for a rise of 1°, is as follows:—Butter = 0·54—0·58; olive oil = 0·6; cotton seed oil = 0·5—0·6; ground nut oil = 0·6—0·7; oil of apricots = 0·4—0·6; sun-flower seed oil = 0·5—0·6; sesame oil = 0·6—0·7; almond oil = 0·5—0·6; oil of peaches = 0·6. No relationship was observed between the refractive power of butter and of deer fat and their iodine absorption value, but high refractive power is accompanied by a relatively great additive power for iodine in the case of the above oils, and also in the following: poppy oil, cocoa nut oil, palm oil, butter (?), tallow, lard, margarine. Nothing is said directly of the volatile fatty acids. J. B. T.

Deer Fat. By HEINRICH BECKURTS and F. OELZE (*Arch. Pharm.*, 1895, **233**, 429—430).—Deer fat melts at 49—49·5° and solidifies at 48°, the corresponding values for tallow and beef fat are 44—45·5° and 32—36°, and 43—44·5° and 37° respectively. The fatty acids of deer fat melt at 49·5°, of tallow at 45—47° of beef fat at 44·5—46°; the iodine absorption values are 19·8—21, 32·7—46·2, and 35·4—44 respectively. The refractive powers (Zeiss' refractometer) at 40° are 44·5, 46, and 45. J. B. T.

Lard Analysis. By A. GOSKE (*Chem. Zeit.*, 1895, **19**, 1043—1045).—The author recommends crystallising the sample from ether at a temperature of 12—13°. With a little practice, it will be found comparatively easy to distinguish microscopically between tallow-stearin and any lard-stearin which, however, does not readily crystallise.

When applying the silver test, the author uses the original Bechi test as approved by the Italian Committee. The test gains in delicacy if the lard is first pressed at a temperature of 26—30°, and the reaction applied to the expressed oil. L. DE K.

Examination of Pepper. By WALTER BUSSE (*Zeit. anal. Chem.*, 1895, **34**, 638—643; from *Arbeiten K. Gesundheitsamte*, **9**, 509).—The methods of estimating moisture, ash, sand, and total alcoholic extract are described. The estimation of the colouring matters, which occur only in the husk, is considered important; these are extracted from the residue insoluble in alcohol by digesting it with hot sodium hydroxide solution, and are precipitated by lead acetate from the extract after acidifying with acetic acid. The amount of lead so precipitated is called the "lead number," and seldom exceeds 0·122 gram per gram of pepper. M. J. S.

Nutmeg. By WALTER BUSSE (*Zeit. anal. Chem.*, 1895, **34**, 643—644; from *Arbeiten K. Gesundheitsamte*, **11**, 390).—The total ash should not exceed 5 per cent., nor the amount insoluble in hydrochloric acid (sand) 0·5 per cent. For estimating the fat, 2 grams of the grated powder is extracted with ether for eight hours, then dried, rubbed down with quartz sand, and again extracted for four hours; after evaporating the ether, the fat is absorbed by 8 grams of ignited sand, and dried at 100° for five hours only, to avoid oxidation. The amount varies from 30 to 40 per cent. M. J. S.

Margarine Cheese and its Analysis. By M. KÜHN (*Exper. Stat. Record*, 1895, **7**, 158; from *Molk. Zeit.*, 1895, **9**, 185—187).—The percentage composition of the cheese is said to be valueless in distinguishing it from natural cheese. The following determinations are recommended to be made in the ether extract; sp. gr. at 100° by means of a Westphal balance and König's butter areometer; insoluble fatty acids (Hehner's method); volatile fatty acids (Reichert-Meissl-Wollny) Köttesdorfer saponification equivalent; angle of refraction in the Zeiss-Wollny butter refractometer. A number of results obtained with different cheeses are given in the original paper. N. H. J. M.

Composition of Meat Extract. By F. JOSEF KÖNIG and A. BÖMER (*Zeit. anal. Chem.*, 1895, **34**, 548—562).—It has hitherto been accepted that meat extracts contain gelatin and other proteïds. Thus, C. Karmrodt found 10·4 per cent. of gelatin in Liebig's extract, Kemmerich (Abstr., 1894, ii, 150) 33·23 per cent. of proteïds, and Stutzer (Abstr., 1893, 146) 20·5 to 22·6 per cent. of peptone. The numbers obtained by Kemmerich were deduced from the results of fractional precipitation by alcohol, on the assumption that gelatin is precipitated by 60 per cent. alcohol, albumoses by 80 per cent., and peptones only by 90 per cent. The authors have repeated Kemmerich's work, but employing Kjeldahl's process, instead of weighing the precipitates, as was done by Kemmerich (a method to which they take exception), have obtained numbers for gelatin and albumoses which are less than one-third of Kemmerich's. In Liebig's extract, the mode of manufacture would seem to exclude the possibility of more than traces of gelatin being present. The usual mode of estimating peptone, namely, precipitation by phosphomolybdic acid, is erroneous, since this reagent gradually (in the course of 5—7 days) throws down the flesh bases also, about 90 per cent. of the total nitrogen being precipitable. The absence of peptone may be shown qualitatively, as after precipitating with ammonium sulphate to ensure the absence of albumoses, the filtrate does not give the biuret reaction. In the cases of Kemmerich's meat peptone, and Cibils' meat extract obtained by means of the digestive ferment of *Carica Papaya*, the filtrate is pale enough for the detection of traces. The filtrates from Liebig's and Kemmerich's meat extracts are darker, but the colour is incompetent to mask the reaction if as much as 2—3 per cent. of peptone is present (see, however, Stutzer, *loc. cit.*). Stutzer's statement as to the presence of ammonia is confirmed, but no evidence could be obtained of the presence of amido- or acid amido-compounds. Albumose (precipitable by ammonium sulphate or zinc sulphate; see next abstract) is the only proteïd present in notable quantity, but the flesh bases constitute by far the largest portion of the total nitrogenous constituents. M. J. S.

Precipitation of Albumoses by Zinc Sulphate. By A. Bömer (*Zeit. anal. Chem.*, 1895, **34**, 562—567).—Zinc sulphate possesses many advantages over ammonium sulphate for the separation of albumose from peptone. The precipitation is equally complete, comparative estimations by means of the two reagents having given identical numbers in the four meat extracts examined by the author and J. König (preceding abstract), whilst the filtrates in all cases gave no indication of the presence of a proteïd by the biuret reaction. The presence of zinc sulphate in no way disturbs the Kjeldahl process, so that the nitrogen in the precipitate can be estimated without the need of applying any correction. The filtrate is at once suitable for precipitation by phosphomolybdic acid, either for the purpose of testing the completeness of the washing or (after strongly acidifying with an equal volume of dilute sulphuric acid, 1 : 4) for the estimation of peptone, flesh bases, &c. Since phosphates give a precipitate with zinc sulphate, it is desirable to slightly acidify the solution with sulphuric acid; 1 c.c. of acid (1 : 4) is therefore to be added to 50 c.c. of solution containing 1—2 grams of the extract, and previously freed from insoluble and coagulable substances; the liquid is then saturated in the cold with a small excess of finely powdered zinc sulphate, and the precipitate washed with a cold saturated solution of the same salt. Although meat extracts contain ammonia, and ammonia forms with zinc sulphate a sparingly soluble double salt, in no case was ammonia found in the albumose precipitate, but, on the contrary, the whole of the ammonia of the original substance was obtained when the filtrate from the zinc precipitate was distilled with sufficient magnesia to precipitate all the zinc present and leave the liquid strongly alkaline. M. J. S.

Estimation of Gelatin in Meat Extracts and Commercial Peptones. By Albert Stutzer (*Zeit. anal. Chem.*, 1895, **34**, 568—570).—The following is the exact method of carrying out the estimation of which the outline was previously given (Abstr., 1895, ii, 543). Sand, previously ignited and freed from fine dust by a sieve, is used instead of asbestos for absorbing the solution in the tinfoil capsule. After complete drying at 100°, the contents of the capsule are powdered, and, with the cut up capsule, placed in a beaker, where they are extracted four times with absolute alcohol, filtering the extracts through an asbestos filter, but leaving as far as possible the insoluble matter in the beaker. The beaker (marked *a*) together with four others (*b*, *c*, *d*, *e*) are then plunged into crushed ice, as also a flask containing a mixture of 100 c.c. of alcohol, 300 grams of ice, and cold water to 1 kilogram. Of this mixture, the temperature of which must not exceed 5°, about 100 c.c. is poured on the sand, stirred therewith for two minutes, and decanted into beaker *b*; the second decantate is poured into *c*, and so on, until the last washing is colourless, a fragment of ice being added to each as soon as it is poured off. Three funnels are then arranged with filter beds of long-fibred asbestos supported by perforated porcelain plates, and connected with a pump by which gentle and gradually increasing suction can be applied. The contents of beaker *a* are filtered through the first, finally transferring the sand to the funnel, *b* is poured into the second, and *c* and *d* into the third. The three filters, as well as that through which the absolute alcohol extract had been filtered, are then thoroughly washed with the ice cold dilute alcohol, transferred to a basin, and repeatedly extracted by boiling with water. The aqueous extract, after filtration, is concentrated and submitted to Kjeldahl's process for the estimation of the gelatin. In the process given in Abstr., 1893, 146, the albumose (line 2 from bottom of page) must be corrected for any coagulable albumin present in the meat extract.

M. J. S.

General and Physical Chemistry.

Dissociation of Optically Active Salts in Solution. By Philippe A. Guye and B. Rossi (*Bull. Soc. Chim.*, 1895, [3], **13**, 464—469).—It is well known that the specific rotatory powers of the salts of optically active monobasic acids, at sufficiently low concentrations, are identical with those of the acids themselves, whilst those calculated from the rotatory powers of more concentrated solutions are usually divergent. Although this is accounted for in a general manner by the theory of electrolytic dissociation, the optically active acids being, as a rule, comparatively little dissociated, and having approximately normal cryoscopic constants and electrolytic conductivities at temperatures at which their salts are almost completely dissociated; yet a complete examination of an individual case has not hitherto been made. The authors have, therefore, determined the rotatory powers of various inorganic and organic salts of active valeric acid, a substance which was chosen on account of the comparative simplicity of its constitution due to the absence of alcoholic hydroxyl.

The specific rotatory power of the aqueous solution of the acid is $[\alpha]_D = +17{\cdot}3°$, whilst that of the pure acid is $+13{\cdot}64°$; but this difference may be due as much to molecular association as to electrolytic dissociation.

The specific rotatory powers of the lithium, sodium, potassium, and rubidium salts at concentrations corresponding with 2·46 grams of the acid in 100 c.c., and calculated on the amounts of the salts actually present, are respectively $[\alpha]_D = +8{\cdot}0°, +7{\cdot}2°, +6{\cdot}4°$, and $+5{\cdot}4°$; whilst those calculated on the amounts of acid present, on the supposition that the salts are completely dissociated into their ions, are respectively $+8{\cdot}5°, +8{\cdot}8°, +8{\cdot}9°$, and $+10{\cdot}1°$. The approximate identity of the rotatory powers of the salts of metals differing so widely in atomic weight, is noteworthy, considering the great difference between those of the alkylic valerates; the lithium, potassium, and rubidium salts are the most dissociated, the mean rotatory power of the three being approximately half that of the acid at the same concentration.

As might be expected from theory, the specific rotatory powers of aqueous solutions of valeric acid are diminished alike by dilution and by rise of temperature. The rotatory power, $[\alpha]_D = +12{\cdot}02°$, of an acid somewhat less active than that used in the foregoing determinations, became $+14{\cdot}6°$ in an aqueous solution containing 3·732 grams per litre, but was diminished to $+14{\cdot}4°$, when the concentration was reduced to 1·239 gram per litre, and was reduced in the two cases to $+14{\cdot}36°$ and $+14{\cdot}2°$, when the temperature was raised from 18° to 25°.

The rotatory powers of aniline, pyridine, and diethylamine valerates in aqueous solutions of the same concentration of acid as those of the alkali salts, and calculated on the amounts of the salts actually present, are $[\alpha]_D = +6{\cdot}30°, +6{\cdot}36°$, and $+4{\cdot}99°$ respectively, whilst those calculated on the amounts present on the hypothesis of complete dissociation are +12·4°, +11·26°, and +8·77°. These results are in harmony with the cryoscopic constants of the bases. The specific rotatory powers of alcoholic solutions of the foregoing salts and of those of dimethylaniline, quinoline, and phenylhydrazine containing the same amounts of acid as before, are practically identical with that of an alcoholic solution of the acid of the same concentration, except in the case of the diethylamine salt, the activity of which is some 50 per cent. less. With this exception, therefore, these salts are completely dissociated in alcoholic solution, a conclusion similar to that arrived at by Ghira from a study of the cryoscopic properties of benzene solutions of the corresponding acetates.

It is thus useless to determine the optical activity of solutions of the organic salts of optically active substances in organic solvents; and where organic solvents are used, investigation must, in future, be limited to inorganic salts. JN. W.

Colour Change of Dilute Solutions of Potassium Chromoxalate. By FRIEDRICH HAMBURGER (*Ann. Phys. Chem.*, 1895, [2], **56**, 173—174).—A dilute solution of potassium chromoxalate, $K_3Cr(C_2O_4)_3$, when placed in a cylindrical vessel was found to exhibit in general a green colour by transmitted daylight, but showed purple streaks at the edges and in the centre. By artificial light, the solution appeared only purple. An examination of the absorption spectrum was therefore made, and showed a wide absorption band between the wavelengths 630 and 530, and complete absorption at the wave-length 470. Hence the yellow, orange, blue, and violet rays are absorbed from the spectrum, only red and indigo remaining; the colour resulting from these two is dependent on the proportion in which they are present in the incident light rays. H. C.

Emission of Light by Organic Substances in the Gaseous, Liquid, and Solid Condition. By EILHARD WIEDEMANN and G. C. SCHMIDT (*Ann. Phys. Chem.*, 1895, [2], **56**, 18—26).—The authors find by numerous experiments that many organic compounds exhibit fluorescence in the gaseous condition; this fluorescence is blue or violet with retene, phenanthrene, anthracene, anthraquinone, chrysene, indigo, and naphthalene, and a magnificent reddish-brown with naphthazarin. The absorption spectra of solutions of the hydrocarbons in this list, all lie in the extreme violet or ultra-violet, and, therefore, as in the case of benzene and toluene, the absorption of the gaseous hydrocarbons probably lies still further towards the ultraviolet end of the spectrum. Anthraquinone also absorbs violet rays, and naphthazarin, in alcoholic solution, green, blue, and violet rays. The emission spectra lie, therefore, in accordance with Stokes' rule, nearer the less refrangible end of the spectrum than the absorption spectra, and the spectra of organic vapours are fluorescence spectra in the usual sense of the term.

Many organic compounds in the gaseous state yield characteristic spectra under the influence of electrical discharges, but the spectra obtained in this way do not correspond with the absorption spectra. In the liquid state many organic compounds become luminous under the influence of the cathode discharge, and the colour in this case is the same as that of the vapour. Solid organic compounds also frequently exhibit cathode-luminosity, but the colour is not in all cases identical with that of the liquid. H. C.

Measurement of High Temperatures. By L. Holborn and W. Wien (*Ann. Phys. Chem.*, 1895, [2], **56**, 360—396).—The Le Chatelier thermo-couple of platinum and a platinum-rhodium alloy containing 10 per cent. of rhodium, has been compared by the authors with the air thermometer up to the temperature 1450°. This instrument gives very constant readings if protected from the possible action of carbon. Its use in high temperature measurements is, therefore, to be preferred to that of employing the change of resistance of a platinum wire, for with the latter, even if between each measurement the temperature coefficient between 0° and 100° is redetermined, this affords no guarantee for the behaviour at high temperatures. The authors find, also, that Callendar's formula for the change of resistance with change of temperature is not sufficiently exact to admit of a far reaching extrapolation. A comparison with the air thermometer can be most readily effected with the thermo-couple, as it can be directly introduced into the air vessel, and must in this way acquire the same temperature as that of the expanding air. The following melting points were measured :—

Silver............	971°	Nickel...........	1484°
Gold.............	1072	Palladium........	1587
Copper..........	1082	Platinum	1780

H. C.

Some Melting and Boiling Points. By Henri Le Chatelier (*Compt. rend.*, 1895, **121**, 323—326).—Experiments made with a thermoelectric couple protected by a thin film of glass and graduated up to the boiling point of zinc (930°) give 1050° to 1060° as the melting point of gold. Experiments made with another couple, taking the melting point of silver as 954°, show that the melting point of gold is 1055—1060°. The author concludes that the melting point of gold as given by Violle, 1045°, is too low, but that the error is certainly not more than 20°, that none of the more recent estimations of this melting point are sufficiently accurate to warrant their substitution for Violle's number, and that it is very desirable to retain the scale of high temperatures at present actually in use until new and more exact experiments made by direct comparison with the air thermometer shall give the true melting point of gold to within a very few degrees (compare Heycock and Neville, Trans., 1895, 1024). C. H. B.

Explosion of Endothermic Gases. By Léon Maquenne (*Compt. rend.*, 1895, **121**, 424—427).—When a small quantity of mercuric fulminate is exploded in contact with nitrous oxide, the latter is decomposed with a violent explosion. Acetylene under similar conditions only begins to decompose, about 95 per cent. of the gas remaining unaltered, and the explosive wave is not propagated through the mass of the gas. With a larger quantity of fulminate (about 1 gram) the acetylene is decomposed, and the explosive wave travels through a distance which depends on the diameter of the tubes and the conditions under which the explosion takes place.

C. H. B.

Nitro-substitutions. By Camille Matignon and Deligny (*Compt. rend.*, 1895, **121**, 422—424).—

	Heat of combustion.		Difference from parent compound.
	Const. volume.	Const. pressure.	
Orthonitrophenol	688·6	688·2	44·3
Paranitrophenol	689·5	689·1	43·4
Orthonitrobenzoic acid .	731·1	730·4	44·0
Metanitrobenzoic acid ..	727·7	727·0	47·4
Paranitrobenzoic acid ..	729·6	728·8	45·5
Paranitroacetanilide....	969·2	968·9	47·9
Nitrobenzaldehyde.....	801·2	800·3	41·4

The third column gives the difference between the heats of combustion, at constant pressure, of the nitro-derivative and the parent substance. The position-isomerides have practically the same heats of combustion. With the exception of nitrobenzaldehyde, the difference is practically constant and is about 45, whatever the function of the compound in which substitution takes place. The equation deduced from this difference is

$$RCH + HNO_3 \text{ liq.} = RCNO_2 + H_2O \text{ liq.} \quad \text{develops } +36{\cdot}7 \text{ Cal.}$$

the thermal disturbance being indentical with that found by Berthelot in the case of the hydrocarbons benzene, toluene, naphthalene, &c.

C. H. B.

Combination of Mercuric Cyanide with Bromides. By Raoul Varet (*Compt. rend.*, 1895, **121**, 398—400).—In the following table, column I, gives the heat of dissolution of the salt, column II the heat developed by the interaction of solutions of mercuric cyanide and the particular bromide, and column III the heat of formation of the solid salt from its proximate constituents, the salts being regarded as solid and the water as liquid.

	I.	II.	III.
$2Hg(CN)_2,2NaBr,4H_2O$...	−24·14 Cal.	+0·98 Cal.	+18·52 Cal.
$2Hg(CN)_2,2NH_4Br,2H_2O$..	−20·97 „	+1·06 „	+ 7·23 „
$2Hg(CN)_2,2LiBr,7H_2O$ ...	−18·31 „	+1·25 „	+36·26 „
$2Hg(CN)_2,BaBr_2,7H_2O$ ...	−20·98 „	+1·29 „	+20·27 „
$2Hg(CN)_2,SrBr_2,6H_2O$ ...	−18·60 „	+1·24 „	+29·84 „
$2Hg(CN)_2,CaBr_2,7H_2O$ ...	−19·82 „	+1·25 „	+40·47 „
$2Hg(CN)_2,MgBr_2,8H_2O$...	−15·97 „	+1·44 „	+54·71 „
$2Hg(CN)_2,ZnBr_2,8H_2O$ ...	−20·82 „	+1·33 „	+31·15 „
$Hg(CN)_2,CdBr_2,3H_2O$	−12·5 „	+0·66 „	+10·5 „

At the ordinary temperature, the solutions are slightly alkaline to litmus, and slowly give the isopurpurate reaction with a picrate of the same base as is combined with the bromine. It follows that whilst almost all the mercury is in combination with cyanogen, a small quantity is in combination with the bromine. The proportion of the latter increases as the temperature rises. These results are in accord with the thermochemical data. C. H. B.

Distillations with an Automatic Mercury Pump. By Friedrich Krafft and W. A. Dÿes (*Ber.*, 1895, **28**, 2583—2589).—The paper contains a description of an air pump devised some 16 years ago by v. Babo. It consists of a Sprengel mercury pump which works in the vacuum of a water suction-pump and so need not be more than 30—40 cm. long; the mercury, which falls down the short Sprengel tube, is carried up again to the top of the apparatus by a current of air drawn in by the water-pump, and the apparatus is thus automatic and continuous in its action. It is comparatively small in size, so that it can be placed, by means of clamps and a retort-stand, on the laboratory bench, and it does not require more than 600—650 grams of mercury; a vacuum of less than 1 mm. is attainable by its means.

By means of this pump the boiling- or sublimation-points of several substances were determined. Mannitol boils at 276—280° under about 1 mm., at 285° under 2·5 mm., and at 290—295° under 3—3·5 mm. pressure. Dulcitol boils at 275—280°, 287—288°, and 290—295° under the same pressures. α-Hydroxybutyric acid boils at 84° under 1·5 mm. pressure. Succinic acid sublimes at 156—157° under 2·2 mm., at 160—165° under 2·5—3 mm. pressure; fumaric acid at 165° under 1·7 mm., mesaconic acid at 139—141° under 1·5 mm., at 143—145° under 2 mm., and itaconic acid at 140—141° under 1·5 mm. pressure; maleic and citraconic acids do not sublime without forming some anhydride. Wood's metal was used to heat the distillation flasks; the temperature of the bath need not be more than a few degrees above the boiling-point of the liquid, but if the substance does not boil, but sublimes, a much greater difference of temperature, 40—60° above the sublimation point, was found to be necessary.

C. F. B.

Density Determinations of Extremely Dilute Solutions. By Friedrich Kohlrausch (*Ann. Phys. Chem.*, 1895, [2], **56**, 185—200).—The author has further improved the method of determining the density of very dilute solutions, which he had formerly employed in conjunction with Hallwachs (Abstr., 1894, ii, 441). The size of the ball of glass used was greatly increased, the suspension from the balance being effected by means of a thin platinum wire which was first coated electrolytically with platinum and afterwards ignited. The rough surface thus produced, satisfactorily removes the difficulties and irregularities observed when a smooth wire is employed. As very slight variations of temperature exercise a very disturbing influence on the results, owing to the unequal expansion of the solution and of the glass ball, it was necessary to confine the observations within limits of temperature between which this influence is at a minimum, the limits within which a variation of a few thousandths of a degree may be allowed, being from 4° to 8°. A limiting error of 10^{-7} has thus been reached in the determinations.

Observations were made with solutions of cane sugar, magnesium sulphate, acetic acid, and sulphuric acid. On the assumption that the water undergoes no contraction in volume, the molecular volumes ϕ of the dissolved substances are calculated by means of the formula

$$\phi = A - 1000\,\frac{s-1}{m},$$

where A is the weight of the equivalent, m the number of gram-equivalents per litre in the solution, and s is the density. The results are given in the following table, and for the purpose of comparison, the results formerly obtained with Hallwachs at the higher temperature of 18° are included.

m.	Sugar. A = 341·1.		Magnesium sulphate. A = 60·23.		Acetic acid. A = 60·00.		Sulphuric acid. A = 49·04.	
	6·0°.	18°.	6·3°.	18°.	5·5°.	18°.	6·0°.	18°.
0·0002	207·0	—	−4·5	—	(51·3)	—	(6·1)	—
0·0006	207·3	—	−4·5	—	(50·0)	—	(5·5)	—
0·001	207·32	209·0	−4·6	—	(49·8)	—	(5·5)	—
0·002	207·41	209·0	−4·6	−3·4	49·61	—	5·9	6·9
0·005	207·48	209·5	−4·14	−3·21	49·69	50·7	6·92	7·94
0·01	207·56	209·59	−3·91	−2·65	49·72	50·88	7·71	9·32
0·03	207·70	209·71	−3·37	−2·15	49·85	51·0	9·75	11·80
0·05	207·8	209·77	−3·03	−1·74	49·88	51·04	10·75	12·77
0·1	208·0	209·89	−2·45	−1·21	49·93	51·10	12·03	14·05
1	209·9	211·5	+0·9	+1·68	50·21	51·34	15·54	16·96
5	—	215·9	+6·0	+6·58	51·05	52·14	17·57	18·52

It will be seen that the continual increase in the molecular volumes with rising concentration is to be observed in these as in the former determinations. The only exceptions occur in very dilute solutions of acetic and sulphuric acids; here a complicated behaviour or disturbance occurs similar to that noticed in conductivity determinations, the molecular contraction increasing only up to a certain degree of dilution, and then decreasing. It is probable that the explanation of this peculiarity may be found in the traces of impurities present in the water used, as these undoubtedly affect the density determinations in these extremely dilute solutions in a marked manner. The molecular volumes are throughout one to two units greater at 18° than at 6°. H. C.

Influence of Hydrochloric acid and Chlorides on the Photochemical Decomposition of Chlorine Water. By Euthyme Klimenko (*Ber.*, 1895, **28**, 2558—2564).—Normal solutions of hydrochloric acid and of various chlorides were diluted with equal volumes of chlorine water and exposed in sealed tubes to sunlight, together with some tubes containing chlorine water only. When the chlorine in the latter had completely disappeared, the other tubes were opened, and the amount of chlorine still remaining in them was estimated. It was found that the hydrochloric acid had most retarded the disappearance of the chlorine, very little chlorine having disappeared in this case; if the amount left in the hydrochloric acid tube be taken as 1, then the amounts left in the tubes containing the chlorides are represented by the following numbers: LiCl 0·308, NaCl 0·173, KCl 0·090, $MgCl_2$ 0·530, $CaCl_2$ 0·390, $SrCl_2$ 0·302, $BaCl_2$ 0·285, $ZnCl_2$ 0·200, $CdCl_2$ 0·042. The different metals group themselves in the same order as in the periodic system.

The action of chlorine on water is said to result in the formation, first of hydrochloric and hypochlorous, and finally of hydrochloric and chloric, acids. The retarding action of hydrochloric acid is ascribed to its reconverting the hypochlorous acid formed into chlorine. It is further suggested that metallic chlorides are partly converted into chlorates by the chloric acid formed, and that the hydrochloric acid thus liberated reacts with hypochlorous acid to reform chlorine, owing to which circumstance the metallic chlorides retard the disappearance of the chlorine. C. F. B.

Heating Apparatus for Drying Ovens. By JOHANNES THIELE (*Ber.*, 1895, **28**, 2601—2602).—The tubes which carry the rows of small jets used in heating drying ovens are usually clamped to the legs of the stand by means of screws; these screws become so hot that it is generally impossible to touch them, and consequently difficult to regulate the temperature of the oven. The author has devised a stand, figured in the paper, in which the tube of jets is carried by a rail that slides up and down between two of the legs, and is pressed against these by a spring, so that it is held fixed in any position. To alter the position, it is merely necessary to press two handles together; these act as levers, and release the pressure of the spring; they are, moreover, fairly long and have wooden ends, so that they do not get too hot to touch. C. F. B.

A Modified Condenser. By J. J. L. VAN RIJN (*Ber.*, 1895, **28**, 2388).—The modification consists in bending the inner tube so that the whole condenser can be rotated, without being removed from the vessel to which it is attached, in such a manner that it can be used either as an ordinary condenser or a reflux condenser.

It appears from the drawing which is appended, that the modified condenser could not be used in connection with any vessel with a narrow aperture. A. H.

Modification of Liebig's Condenser. By HUGO MICHAELIS (*Ber.*, 1895, **28**, 2615).—The author brought forward the modification recently described by van Rijn (preceding abstract) about 10 years ago (*Chem. Zeit.*, 1886, 1556). A. H.

Inorganic Chemistry.

Decomposition of Hydrogen Peroxide. By Walthère Spring (*Zeit. anorg. Chem.*, 1895, **10**, 161—176).—When a 38 per cent. solution of hydrogen peroxide is heated at 60° in a platinum dish which has been previously polished, no decomposition takes place; at a higher temperature small bubbles of gas are formed. When, however, the inside of the dish is scratched with a needle, small gas bubbles are formed at the scratch, even at the ordinary temperature, and on raising the temperature a brisk evolution of gas takes place. A 70 per cent. solution of hydrogen peroxide contained in a glass flask is only slowly decomposed when a current of air from a wide tube is passed through it; if, however, a capillary tube is used, brisk decomposition takes place.

The author has examined the decomposition of hydrogen peroxide when mixed with various solutions. Five c.c. of a 36 per cent. hydrogen peroxide solution is mixed with 5 grams of each solution, and allowed to remain for a given time at 65° in a thermostat, and the remaining hydrogen peroxide titrated in acid solution with permanganate; the solutions employed contain 1 gram mol. of dry salt to 38·5 gram mols. of water. Hydrochloric and nitric acids decompose the peroxide quickly, but sulphuric and phosphoric acids have a preservative action. The decomposing action of salt solutions is more energetic the feebler the base they contain and the more readily the acid they contain is oxidised or reduced by hydrogen peroxide; thus, lithium and sodium sulphates produce only a slight decomposition, magnesium chloride about double, and aluminium chloride about treble this decomposition, whilst sodium and potassium carbonates entirely decompose hydrogen peroxide. This decomposition is due to the acid function which hydrogen peroxide evinces towards some salts. If a solution of hydrogen peroxide is gradually added to a solution of an alkali carbonate, pure oxygen is evolved; if, however, the carbonate is added to an excess of hydrogen peroxide, it is completely converted into alkali dioxide and carbonic anhydride. The ratio of the concentration of two solutions of a salt is not equal to the ratio of their decomposing action on hydrogen peroxide. E. C. R.

Action of Hydrogen Peroxide on Ammoniacal Copper Compounds: Preparation of Oxygen. By Dioscoride Vitali (*L'Orosi*, 1895, 1—5).—When hydrogen peroxide is added to ammoniacal copper sulphate, a brisk effervescence takes place in the cold, and oxygen is evolved in abundance, the copper salt remaining unchanged; and as an indefinite amount of the peroxide can be decomposed by means of the same portion of the metallic compound, pure oxygen may be very conveniently prepared by allowing the ordinary aqueous peroxide (3—4 per cent.) to flow steadily from a tap-funnel into a saturated solution of ammoniacal copper sulphate

(20—30 c.c.) contained in a fairly capacious Woulff's bottle. The gas is dried and purified from ammonia by means of sulphuric acid.

The mechanism of the action appears to be analogous to that of the decomposition of potassium chlorate in presence of manganese dioxide; the cupric compound reacts with the peroxide, yielding a cuprous salt and free oxygen, and the cuprous compound is then re-oxidised by another portion of the peroxide.

The same action occurs to a limited extent with copper hydroxide alone, and to a varying extent with ammoniacal solutions of other metallic salts, but in no case is it continuous as with copper; mercuric oxide and mercurous nitrate, for instance, are visibly reduced, and the action ceases as soon as the reduction is complete.

The method is not applicable to the estimation of hydrogen peroxide in aqueous solution, as the whole of the oxygen is not evolved, part being employed in oxidising ammonia to nitrous and nitric acids, which may be detected in the solution at the end of the operation.

JN. W.

Formation of Ozone. By OTTO BRUNCK (*Zeit. anorg. Chem.*, 1895, **10**, 222—247; see also Abstr., 1893, ii, 454).—The author has already proved that the intense odour of the oxygen prepared from a mixture of potassium chlorate and manganese dioxide is chiefly due to the presence of ozone. A further examination of the gas shows that only a very minute trace of chlorine is evolved, equal in amount to that evolved in the decomposition of pure potassium chlorate alone. The gas examined was evolved at a temperature of 320°. If the mixture is heated at 400° and above, at which temperature the dioxide commences to decompose, then more chlorine is evolved.

It has already been shown that oxygen is ozonised when passed over heated manganese dioxide or certain other metallic oxides, and this action has been further examined. The ozone is estimated as follows: the gas is passed through a neutral solution of potassium iodide, which is then acidified with dilute sulphuric acid, and titrated with N/100 sodium thiosulphate solution. The action of ozone on an acidified potassium iodide solution takes place according to the equation $O_3 + 2KI = 2I + K_2O + O_2$; when, however, ozonised oxygen is passed through a neutral solution of potassium iodide, the action takes place according to the equations $O_3 + 2KI = 2I + K_2O + O_2$ and $6I + 3K_2O = KIO_3 + 5KI$. The second reaction does not take place quantitatively, and there remains free iodine and potassium hydroxide in the solution; the latter is partially converted by the ozone into potassium dioxide, so that finally the solution contains potassium iodate, potassium hydroxide, and potassium dioxide. Hydrogen peroxide is not formed. When the solution is acidified, a third part of the iodine, equivalent to the ozone, is liberated at once, whilst the reaction with the hydrogen peroxide liberated from the potassium dioxide is only complete after 1—2 hours.

Manganese dioxide when heated in a current of carbonic anhydride at 400°, and to an incipient red heat, does not yield ozone. In a current of oxygen at 400°, 6·5 grams of the dioxide gave in one hour 9·57 milligrams of ozone; at an incipient red heat, it gave 7·46 milligrams. The formation of ozone from a mixture of potassium chlorate and manganese dioxide increases with the amount of manganese dioxide; manganous oxide acts in a similar way to the dioxide, but much less ozone is formed.

Cobalt oxide, Co_2O_3, behaves in a similar way to manganese dioxide, but in the presence of nascent oxygen the amount of ozone formed is greater in proportion to the amount of cobalt oxide employed. The compound $K_2Co_9O_{16}$, prepared by fusing cobalt carbonate with potassium hydroxide, when heated at 200° gives off three atoms of oxygen, but no ozone is formed.

Nickel oxide behaves in a similar way to the above; apparently, it is not altered by heating in oxygen, and after heating some time still evolves chlorine when treated with hydrochloric acid, and ozone when again heated in oxygen. The reaction with potassium chlorate takes place violently at 300°, and less ozone is formed than in the case of cobalt.

Silver oxide, when heated in a current of carbonic anhydride at 250°, gives only a slight trace of ozone, which is probably due to the action of the oxygen formed on undecomposed oxide; in a current of oxygen at 280°, it forms ozone. Silver peroxide was prepared by the electrolysis of silver nitrate; 1·22 gram heated at 300° gave 7·68 milligrams of ozone. Only a very small quantity of oxygen is evolved from a mixture of silver oxide and potassium chlorate at 360°; above 400°, the chlorate decomposes slowly without the formation of ozone.

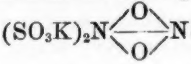
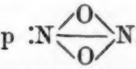
Mercuric oxide when heated at 400° does not give off ozone, but when heated in a current of oxygen, a small quantity of ozone is formed; probably the greater part of the ozone is destroyed by the metallic mercury. With potassium chlorate, it behaves in a similar way to silver oxide.

Lead peroxide yields ozone when heated either in a current of carbonic anhydride or of oxygen, but with potassium chlorate at 320—350°, only a very small quantity of ozone is formed, and the peroxide is reduced to red lead and litharge. When heated to redness in a current of oxygen, red lead and litharge yield small quantities of ozone.

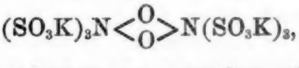
Chromic anhydride (3·39 grams), when heated at 260—280°, yields ozone (1·52 milligram). Chromium oxide heated at 400° in a current of oxygen, yields small quantities of ozone.

Uranium trioxide does not yield ozone in an atmosphere of carbonic anhydride; in oxygen, small quantities of ozone are formed. When heated with potassium chlorate, it yields potassium uranate and chlorine. The hydrate of the tetroxide, when heated at 150° in a current of carbonic anhydride, yields water and oxygen, but no ozone is formed, as probably hydroxyl groups are eliminated, which decompose into water and oxygen.

The author was unable to detect the formation of ozone from platinum oxide, as the compound always contains chlorine, which is evolved on heating. Gold oxide was prepared by precipitation of gold chloride with potassium hydroxide; the mixture is acidified with sulphuric acid, and the precipitate dissolved in nitric acid, reprecipitated by dilution with water, and dried at 150°; 1·44 grams of the oxide heated in a current of carbonic anhydride at 230—280° gave 21 milligrams of ozone, and 1·85 grams heated in oxygen gave 34·4 milligrams of ozone. E. C. R.

The so-called Oxysulphazotic acid or Nitrosodisulphonic acid. By ARTHUR R. HANTZSCH and WILLIAM SEMPLE (*Ber.*, 1895, **28**, 2744—2751).—Potassium nitrosodisulphonate, $ON(SO_3K)_2$, prepared by the oxidation of potassium hydroxylaminedisulphonate by means of lead peroxide, has, according to Raschig, the formula  $(SO_3K)_2N\left\langle\begin{matrix}O\\O\end{matrix}\right\rangle N(SO_3K)_2$; to this the authors make the following objections: (1) The group  $:N\left\langle\begin{matrix}O\\O\end{matrix}\right\rangle N:$ has never previously been observed, and its chromophoric character has not been proved; (2) the acidic character of two linked pentavalent nitrogen atoms is unique; (3) the difficulty of explaining the change of colour from orange-yellow to deep violet-blue which takes place when the salt is dissolved; (4) when reduced, no hydrazine derivatives are formed. The authors regard the compound as a derivative of nitric peroxide with the simple formula $ON(SO_3K)_2$, the oxidation of nitrous acid to nitric peroxide, and of potassium hydroxylaminedisulphonate to potassium nitrosodisulphonate being analogous, the relationship between the yellow solid salt and the blue solution is similar to that between colourless solid N_2O_4 and coloured NO_2. Cryoscopic molecular weight determinations failed to give satisfactory results on account of the instability of the compound. If the oxidation of the hydroxylamine derivative is incomplete, blue crystals are formed; these are also obtained by mixing solutions, saturated at 40°, of potassium hydroxylaminedisulphonate (3·5—4 parts) and potassium nitrosodisulphonate (1 part), and consist of solid solutions containing 1—4 per cent. of the latter in the former. The colour of the crystals varies, according to the composition, from ultramarine to sky blue, they are comparatively stable, and the content of nitrosodisulphonate may be determined by means of potassium iodide and acetic acid, titrating the liberated iodine with potassium thiosulphate.

Raschig's potassium nitrosotrisulphonate,

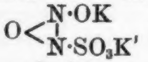


$$(SO_3K)_3N\left\langle\begin{matrix}O\\O\end{matrix}\right\rangle N(SO_3K)_3,$$

formed by the action of water on potassium nitrosodisulphonate, is also regarded as monomolecular $ON(SO_3K)_3$; cryoscopic molecular weight determinations were unsatisfactory, and the electrolytic conductivity of its solution does not follow Ostwald's rule, but it is similar to "dibenzsulphhydroxamic acid," $ON(SO_2Ph)_3$, the molecular weight of which agrees with the formula. Raschig's objection to the simpler formula for potassium nitrosotrisulphonate was based on its non-formation by the oxidation of potassium azotrisulphonate,

$N(SO_3K)_3$; but this has little weight since tertiary ammonium derivatives do not yield amine oxides, ONR_3, when oxidised.

J. B. T.

Dinitrososulphonic acid (Nitroxysulphurous acid). By Arthur R. Hantzsch (*Ber.*, 1895, **28**, 2751—2754).—The author replies to Divers and Haga's criticisms (Trans., 1895, 452) of his previous paper on this subject (Abstr., 1895, ii, 75). Their statement that he believes in the existence of two potassium nitroxysulphites is based on a misapprehension, as reference to his paper shows, and he takes exception to their formula $OK\cdot N\!:\!NO\cdot SO_3K$ on the following grounds: (1) The salt, being similar to nitrosylsulphuric acid, $O\!:\!N\cdot O\cdot SO_3H$, should be readily hydrolysed to sulphuric acid and hyponitrous acid; actually it is, in alkaline solution, very stable. (2) Until decomposed it does not give the reactions of the sulphates as might be expected. (3) Their general remarks on acids and bases are in conflict with the theory of dissociation. (4) The fact that alkyl hydrogen sulphates are not directly precipitated by barium chloride is explained by the fact that all alkyl derivatives are non-electrolytes. The above objections do not apply to the author's formula  $O<\begin{matrix}N\cdot OK\\ |\\ N\cdot SO_3K\end{matrix}$, with which Raschig's $ON\cdot N(OK)\cdot SO_3K$ may be tautomeric (compare Divers and Haga, Trans., 1895, 1098).

J. B. T.

Formation of Hydrogen Selenide. By H. Pélabon (*Compt. rend.*, 1895, **121**, 401—404; compare Abstr., 1894, ii, 135 and 447).—In order to avoid any error that may arise from the fact that when selenium is heated in a mixture of hydrogen and hydrogen selenide, it absorbs a certain quantity of the latter, which is partially liberated on cooling, the author has determined by Ditte's method the composition of the gas obtained by heating hydrogen at various temperatures in presence of the smallest possible excess of selenium. The relation p_1/p_2 of the partial pressure of the hydrogen to that of the hydrogen selenide was determined for each temperature, and the results are expressed with great accuracy by the equation of Gibbs and Duhem, $\log (p_1/p_2) = M/T + N \log T + Z$, in which M, N, and Z are constants, T is the absolute temperature of the experiment, and the logs are Napierian logs. Experiments at 350°, 440°, and 510° give 13170·3, 15·53, and 119·88 respectively for the values of M, N, and Z. It follows from the equation that the ratio $r = p_2/\overline{p_1 + p_2}$ should have a maximum value at the temperature t when $t = M/N - 273$. With the values already given for M and N, $t = 575°$, and this deduction is confirmed by experiment. It also follows from Duhem's equations and the values found for M and N that the heat of formation of hydrogen selenide should be −17380 minor calories, whereas Fabre's experiments gave the value −18000.

C. H. B.

Tellurium. By Ludwig Staudenmaier (*Zeit. anorg. Chem.*, 1895, **10**, 189—221).—Telluric acid is most easily obtained by dissolving tellurium in an excess of dilute nitric acid and then adding a slight excess of chromic acid. The solution is evaporated to crystallisation and the crystals washed with nitric acid and dissolved in a small quantity of water. The solution is treated with a few drops of alcohol to reduce any chromic acid remaining, and precipitated by the addition of nitric acid. Finally, the product is dissolved in water and evaporated to dryness on the water bath. Telluric acid separates from water at the ordinary temperature in crystals, with $2H_2O$, belonging to the irregular system; these are stable in the air, and are not hygroscopic. When precipitated from its aqueous solution with nitric acid, regular crystals resembling lead nitrate are obtained, together with the ordinary modification; these also contain $2H_2O$. From solutions at 0°, it crystallises with $6H_2O$ in large, tetragonal crystals resembling monopotassium phosphate; these crystals effloresce at the warmth of the hand, and are converted into the ordinary modification. When dried over phosphoric acid, they do not decompose even in a vacuum.

Pure tellurium compounds are obtained from the crude Hungarian tellurium as follows. The finely powdered substance is dissolved in dilute nitric acid, the solution evaporated with strong hydrochloric acid, and filtered; the tellurium is then precipitated from the filtrate with sulphurous acid, and after being washed with hydrochloric acid and water, it is dissolved in nitric acid, oxidised with chromic acid, and the telluric acid treated as described above.

The atomic weight of tellurium was determined in accordance with the following equations $H_2TeO_4,2H_2O = TeO_2 + O + 3H_2O$ or $Te + 3O + 3H_2O$ and $TeO_2 = Te + O_2$. The first decomposition is brought about by heating in a glass flask. The reduction in the second and third decomposition is performed as follows. The telluric acid or dioxide is mixed with finely divided silver and pure silica, and the mixture contained in a platinum or porcelain boat, covered with a layer of finely divided silver. The admixture with silver prevents the slightest trace of tellurium from volatilising. The mixture is first heated in a glass tube until the telluric acid is dehydrated, then in a current of hydrogen, while the temperature is gradually raised from 250° to 400°, and finally for a short time at a dull red heat. The results of all the experiments (number of experiments not stated) agree closely with 127·6 ($O = 16$) for the atomic weight of tellurium.

Experiments on the fractional crystallisation of telluric acid are described, which show that all fractions give the same atomic weight. The author discusses at length the work of Brauner (Trans., 1889, 382; 1895, 549) and of Retgers (*Zeit. physikal. Chem.*, 1893, **12**, 596).

E. C. R.

A Hydrate of Arsenic Trisulphide and its Decomposition by Pressure. By WALTHÈRE SPRING (*Zeit. anorg. Chem.*, 1895, **10**, 185—188).—The *hydrate*, $As_2S_3 + 6H_2O$, is obtained by precipitating a solution of arsenic trichloride containing hydrochloric acid with hydrogen sulphide, and drying the precipitate in a current of air having a relative humidity of 70 per cent. at the ordinary temperature. It has a somewhat lighter yellow colour than ordinary arsenic trisulphide, and easily loses its water when warmed. The sp. gr. = 1·8806 at 25·6°, and the specific volume = 53·174; whereas the specific volume of the sum of its constituents As_2S_3 and $6H_2O$ is 50·626, therefore, according to the author's theory, it must decompose when submitted to pressure. It is, in fact, decomposed quantitatively into water and anhydrous trisulphide when submitted to a pressure of 6000—7000 atmospheres. If the density of ice is taken for the calculation of the specific volume of the hydrate, the number 52·662 is obtained, which shows that the water is present in the solid form.

E. C. R.

The Compounds of Arsenic with Selenium and of Arsenic, Selenium, and Sulphur. By EMERICH SZARVASY (*Ber.*, 1895, **28**, 2654—2661; compare Clever and Muthmann, this vol., ii, 18).—*Arsenic pentaselenide*, As_2Se_5, was prepared by heating the two constituents in the requisite proportion in sealed tubes filled with nitrogen; it forms a black, lustrous, brittle mass, and may be purified by fractional distillation under diminished pressure. It is not readily acted on by the ordinary solvents, but fuming nitric acid oxidises it to selenious and arsenic acids. Alkaline hydroxides and hydrosulphides readily dissolve it, but the resulting yellow solutions decompose when exposed to the air, and, when acidified with the mineral acids, yield the pentaselenide in the form of a reddish-brown, flocculent precipitate. Vapour density determinations made at 750—800° show that the molecule of As_2Se_5 has undergone decomposition, probably into As_2Se_3 and Se_2; at still higher temperatures (1050—1100°) the vapour density shows that the molecule of As_2Se_5 has split up into three simpler molecules.

Sodium monoselenoarsenate, $Na_3AsO_3Se + 12H_2O$, is one of the compounds formed on dissolving arsenic pentaselenide in sodium hydroxide, but as the solution readily decomposes when exposed to the air, it is necessary to work in an atmosphere of hydrogen. The salt may be obtained as colourless crystals on the addition of methylic alcohol to the aqueous solution; the crystals, when left exposed to the air, lose their water of crystallisation and turn red, owing to the liberation of selenium.

Sodium selenoarsenate, $Na_3AsSe_4 + 9H_2O$, obtained together with the preceding compound when arsenic pentaselenide is dissolved in sodium hydroxide, crystallises in ruby-red needles, which rapidly lose their water of crystallisation when exposed to the air; it is readily soluble in water, and the solution readily undergoes decomposition, selenium being deposited. Mineral acids throw down the pentaselenide from its alkaline solutions in the form of a reddish-brown flocculent precipitate.

Arsenic triselenobisulphide, $As_2Se_3S_2$, is obtained when arsenic bisulphide and selenium are heated together in the requisite proportions in an atmosphere of nitrogen; it is best purified by repeated distillation under low pressure, and then forms a black, highly glistening substance which, in thin plates, has a purple-red colour. In chemical properties it resembles arsenic pentaselenide; it is soluble in alkalis, and is precipitated unaltered on the addition of an acid. Vapour densities taken at 550—600° indicated that dissociation had taken place.

Arsenic diselenotersulphide, $As_2Se_2S_3$, may be obtained in a similar manner from arsenic tersulphide and selenium. It differs from the preceding compound in being ruby-red in thin plates. The vapour density at 750° indicates that dissociation has taken place.

J. J. S.

Atomic Weight of Helium. By N. A. LANGLET (*Zeit. anorg. Chem.*, 1895, **10**, 289—292).—The helium was prepared as follows. A hard glass tube, 1 metre long, is filled first with a column (10 cm. long) of manganese carbonate, then with a mixture of powdered cleveite (3 parts) and potassium pyrosulphate (2 parts), and then with a column (10 cm. long) of copper oxide. The air is expelled from the tube by carbonic anhydride, the copper oxide heated to redness, and the tube then heated, as in the case of an organic analysis. The gas produced is collected over 50 per cent. potassium hydroxide, and finally passed through a tube containing layers of copper oxide, phosphoric anhydride, and magnesium powder, the copper oxide and magnesium being heated to redness. The gas so prepared, when examined spectroscopically in a Giessler's tube, was found to be free from nitrogen, hydrogen, and argon. The density was determined by weighing 100 c.c. in a glass balloon, and was found to be 0·139 (air = 1) or 2·00 (H = 1). The velocity of sound in the gas was then determined, and from this the ratio of the specific heats at constant pressure and at constant volume. The ratio obtained = 1·67, whence the molecule of helium contains only one atom, and the atomic weight = 4. E. C. R.

Combination of Magnesium with Argon and with Helium. By LOUIS J. TROOST and LÉON V. R. OUVRARD (*Compt. rend.*, 1895, **121**, 394—395).—It is not indispensable to pass a mixture of argon and helium with nitrogen over red-hot magnesium or lithium before introducing it into the spectrum tubes. The tubes are furnished with magnesium wires, and a Ruhmkorf coil is used which has a Marcel-Deprez contact breaker. The dry gas is introduced, and a powerful current is passed. At first the nitrogen is slowly absorbed, but when the pressure is reduced to a certain point, the magnesium wires become very hot, and the nitrogen combines with the metal very rapidly. The nitrogen spectrum disappears, and that of helium or argon, or both, becomes visible.

If a powerful discharge is continued for some time, the argon and helium disappear, seemingly because they combine with *the vapour* of the magnesium. Platinum under similar conditions seems likewise to volatilise and combine with argon. C. H. B.

Argon, a New Constituent of the Atmosphere. By LORD RAYLEIGH and WILLIAM RAMSAY (*Phil. Trans.*, 1895, **186**, 187—241).—It has been shown by Rayleigh that nitrogen extracted from chemical compounds is about ½ per cent. lighter than "atmospheric nitrogen" (Abstr., 1895, ii, 444), the chemically prepared nitrogen previously used having been obtained from nitric oxide, from nitrous oxide, and from ammonium nitrite by the use of hot iron. As it appeared desirable to show that the agreement of numbers obtained for chemical nitrogen does not depend on the use of a red heat in the process of purification, experiments were tried with nitrogen liberated from carbamide by the action of sodium hypobromite, which gas it was hoped would require no further purification than drying. But the gas so obtained was obviously contaminated, attacked vigorously the mercury of the Töpler pump, and was described as smelling like a dead rat. Its weight proved to be in excess even of the weight of atmospheric nitrogen, and it was only after passing the gas over hot metals that the corrosion of the mercury and the evil smell were in great degree obviated, and the weight was found to correspond with that of the chemical nitrogen previously examined. Nitrogen can, however, be prepared from ammonium nitrite without the employment of hot tubes, which, in spite of a slight nitrous smell, shows no appreciable difference in density from that prepared by treatment with hot metals.

To the above list may be added nitrogen, prepared in yet another manner, whose weight was determined subsequently to the isolation of the new dense constituent of the atmosphere; in this case the nitrogen was actually extracted from air by means of magnesium. The nitrogen thus separated was then converted into ammonia by the action of water on the magnesium nitride, and afterwards liberated in the free state by means of calcium hypochlorite. The purification was conducted in the usual way, and included in one case passage over red-hot copper and copper oxide, but this was subsequently omitted. With or without exposure to red-hot copper, the "chemical" nitrogen derived from "atmospheric" nitrogen possesses the usual density.

Experiments were also made to prove that the ammonia produced from the magnesium nitride is identical with ordinary ammonia, and contains no other compound of a basic character. For this purpose, the ammonia was converted into ammonium chloride and the percentage of chlorine determined by titration with a solution of silver nitrate, which had been standardised with pure sublimed ammonium chloride. It was found that ammonium chloride prepared from magnesium nitride obtained by passing atmospheric nitrogen over red-hot magnesium contains practically the same percentage of chlorine as pure ammonium chloride. It may be concluded, therefore, that red-hot magnesium withdraws from atmospheric nitrogen no substance other than nitrogen capable of forming a basic compound with hydrogen.

That the discrepancy between the weights of chemical and atmospheric nitrogen cannot be due to the presence of known impurities has already been proved (*loc. cit.*). It was thought that the lightness of the gas extracted from chemical compounds might be explained by partial dissociation of nitrogen molecules N_2 into detached atoms. But as the silent electric discharge has no effect on the density of either kind of gas, and as the density of a sample of chemically prepared nitrogen showed no sign of increase after storage of the gas for eight months, this view had to be abandoned. Regarding it as established that one or other of the gases must be a mixture, the simplest assumption, in view of the above facts, was to admit the existence of a second ingredient in air, from which oxygen, moisture, and carbonic anhydride had already been removed. If the density of the supposed gas were double that of nitrogen, $\frac{1}{2}$ per cent. only by volume would be needed, or, if the density were but half as much again as that of nitrogen, then 1 per cent. would still suffice.

The positive evidence in favour of the prevalent doctrine that the inert residue from air after withdrawal of oxygen, water, and carbonic anhydride is all of one kind appears to be derived from the experiments of Cavendish (*Phil. Trans.*, 1785, **75**, 372). By sparking a mixture of air and oxygen in the presence of alkali for the absorption of the acid product of the reaction, and subsequent removal of the excess of oxygen by a solution of liver of sulphur, Cavendish found that only a small bubble of air remained unabsorbed, "which certainly was not more than 1/120th of the bulk of the" nitrogen "let up into the tube," and therefore concluded "that if there is any part of the" nitrogen "of our atmosphere which differs from the rest, and cannot be reduced to nitrous acid, we may safely conclude that it is not more than 1/120th part of the whole." Cavendish was satisfied with this result, and does not decide whether the small residue was genuine, but the experiments hereafter described render it not improbable that his residue was really of a different kind from the main bulk of the nitrogen, and contained the gas now called argon.

With a view of isolating, if possible, the unknown and overlooked constituent, or, it might be, constituents, the existence of which in atmospheric nitrogen had thus been rendered probable, this gas was submitted to examination.

The earliest attempts to isolate the suspected gas were made by the method of Cavendish, using a Ruhmkorff coil of medium size actuated by a battery of five Grove cells. When the mixed gases were in the right proportion, a rate of absorption of about 30 c.c. per hour could be attained. In a particular instance, starting with 50 c.c. of air and gradually adding oxygen, the volume was at length reduced to 1 c.c. On treatment with alkaline pyrogallol, the gas shrank to 0·32 c.c. That this small residue could not be nitrogen was argued from the fact that it had withstood the prolonged action of the spark, although mixed with oxygen in nearly the most favourable proportion. To this residue another 50 c.c. of air was added, and the whole worked up with oxygen as before. The residue was now 2·2 c.c., and after removal of oxygen 0·76 c.c. In another case, a mixture of 5 c.c. of air with 7 c.c. of oxygen was sparked for one hour and a quarter, the residue was 0·47 c.c., and, after removal of oxygen, 0·06 c.c. Several repetitions giving similar results, it became clear that the final residue did not depend on anything that might happen when sparks passed through a greatly reduced volume, *but was in proportion to the amount of air operated on.*

Difficulty was experienced in accumulating a sufficient quantity for examination of the residue which refused to be oxidised, owing, as was proved later on, to the solubility of the gas in water. At length, however, a sufficiency was collected to allow of sparking in a specially constructed tube, when a comparison with the air spectrum, taken under similar conditions, proved that, at any rate, the gas was not nitrogen.

Since nitrogen, at a bright red heat, is easily absorbed by magnesium, best in the form of turnings, an attempt was successfully made to remove that gas from the residue left after eliminating oxygen from air by means of red-hot copper. In a preliminary experiment, in which a quantity of atmospheric nitrogen was admitted into contact with red-hot magnesium, pumped off, and then treated again with fresh magnesium, the original volume of 1094 c.c. was reduced to 50 c.c., which resisted rapid absorption. It still contained nitrogen, however, judging by the diminution of volume which it experienced when allowed to remain in contact with red-hot magnesium. Its density was, nevertheless, determined by weighing a small bulb of about 40 c.c. capacity, first with air and afterwards with the gas. The density found was 14·88, and the gas, therefore, was heavier than air.

An arrangement was then adopted by means of which a quantity of atmospheric nitrogen could be brought repeatedly into contact with fresh quantities of magnesium heated to redness. About 10 litres of gas were taken and treated in this manner, until the volume was reduced to 200 c.c. Unfortunately some of the nitrogen was lost by leakage, so that exact measurements could not be taken. The density of this residual gas was found to be 16·10, but as it appeared advisable to continue the absorption of nitrogen, it was again treated with fresh magnesium. The volume was thus reduced to a little over 100 c.c., and the density was now found to be 19·086 ($O = 16$). A portion of the gas was then mixed with oxygen, and submitted to a rapid discharge of sparks for four hours in presence of caustic potash. It contracted, and on absorbing the excess of oxygen with alkaline pyrogallol, the contraction amounted to 15·4 per cent. of the original volume. If the gas contained 15·4 per cent. of nitrogen of density 14·014, and 84·6 per cent. of other gas, the density of the mixture being 19·086, calculation leads to the number 20·0 for the density of this other gas.

A vacuum-tube was filled with a specimen of the gas of density 19·086, and it could not be doubted that it contained nitrogen, the bands of which were distinctly visible. It was probable, therefore, that the density of the pure gas lay not far from 20 times that of hydrogen. At the same time many lines were seen which could not be recognised as belonging to the spectrum of any known substance.

If atmospheric nitrogen contains two gases of different density, it should be possible to obtain direct evidence of the fact by the method of atmolysis, and experiments were made with this object. The atmolyser was prepared by combining a number of churchwarden tobacco pipes; eight pipes connected in simple series, and placed in a large glass tube, closed in such a way that a partial vacuum could be maintained in the space outside the pipes by a water-pump, giving the best results thus obtained. One end of the combination of pipes was connected with the interior of an open bottle containing sticks of caustic alkali, the object being mainly to dry the air. The other end of the combination was connected to a bottle aspirator, initially full of water, and so arranged as to draw about 2 per cent. of the air which entered the far end of the pipes. The air thus obtained was treated exactly as ordinary air had been treated in determinations of the density of atmospheric nitrogen. The density of the gas from the above prepared air was in every case greater than that from unprepared air, and to an extent much beyond the possible errors of experiment. The conclusion seems inevitable that "atmospheric nitrogen" is a mixture and not a simple body.

To complete the verification, negative experiments were made to prove that argon is not derived from nitrogen or from chemical sources. In one case 3 litres, and in another case about 5½ litres of chemical nitrogen, prepared from ammonium nitrite, were treated with oxygen in precisely the manner in which atmospheric nitrogen had been found to yield argon. The final residue was in neither case more than 3·5 c.c., and this consisted mainly of argon, the source of which is to be found in the water used for the manipulation of the large quantities of gas employed. If atmospheric nitrogen had been used, the final residue should have been about 10 times the above amount. A similar set of experiments was carried out with magnesium, and led to the same conclusion.

A description is given of the methods adopted for the separation of argon on a large scale, both by the oxygen and the magnesium process. In the latter case, a quantitative experiment was carried out on a large scale, the amount of argon from 100 litres of "atmospheric" nitrogen, measured at 20°, being collected after treatment with magnesium, and measured at 12°. An accident led to the loss of about 4 litres of nitrogen during the process, and the total residue, after absorption of the nitrogen, being 921 c.c., the yield is therefore 0·986 per cent. It may be concluded, with probability, if allowance be made for the solubility of the argon in the water over which it was collected, that argon forms approximately 1 per cent. of the atmospheric nitrogen. This result is confirmed by determinations in which the oxygen method of absorption was used, two independent observations giving 1·04 and 1·03 as the percentage of argon in atmospheric nitrogen.

Determinations of the density of argon prepared by means of oxygen, and of argon prepared by means of magnesium were made. A single determination of the gas obtained by the first method gave 19·7, and the mean of three results obtained with gas prepared by the second process was 19·88.

The spectrum of argon has been examined by Crookes, and forms the subject of a separate communication. Seen in a vacuum tube of about 3 mm. pressure, it consists of a great number of lines, distributed over almost the whole visible field. Two lines are specially characteristic; they are less refrangible than the red lines of hydrogen or lithium, and serve well to identify the gas when examined in this way. The wave lengths of these lines are 696·56 and 705·64 $\times 10^{-6}$ mm. Besides these red lines, a bright yellow line, more refrangible than the sodium line, occurs at 603·84. A group of five green lines occurs next, of which the second is perhaps the most brilliant, and has the wave length 561·00. There is next a blue line of wave length 470·2, and then five strong violet lines of which the fourth is the most brilliant, and has the wave length 420·0.

When the current is passed from the induction coil in one direction, that end of the capillary tube next the positive pole appears of a redder, and that next the negative of a bluer hue. There are, in effect, two spectra, which Crookes has succeeded in separating to a considerable extent. A phenomenon of this order has been attributed to the presence of two gases, and the conclusion would follow that argon is in reality a mixture of two gases, which have as yet not been separated. This conclusion is, if true, of great importance, and experiments are in progress to test it by other physical methods.

Crookes and also Schuster have proved the identity of the chief lines of the spectrum of gas separated from air-nitrogen by aid of magnesium with that remaining after sparking air-nitrogen with oxygen, in presence of caustic soda solution.

The solubility of argon in water has been already alluded to, and special experiments were tried to determine the degree of solubility. The course marked out by Bunsen was followed. The solubility of the gas isolated by means of oxygen was found to be 3·94 per 100 of water at 12°, and argon prepared by means of magnesium gave a result of 4·05 per 100 of water. The solubility is therefore about 2½ times that of nitrogen. The fact that the gas is more soluble than nitrogen led to the expectation of finding it in increased proportion in the dissolved gases of rain water, an anticipation which experiment confirmed.

The behaviour of the gas at low temperatures was examined by Olszewski, whose results are published separately. The following tables are given for convenience of reference.

Vapour Pressures.

Temp.	Pressure.	Temp.	Pressure.	Temp.	Pressure.
−186·9°	740·5 mm.	−136·2°	27·3 atms.	−129·4°	35·8 atms.
−139·1	23·7 atms.	−135·1	29·0 "	−128·6	38·0 "
−138·3	25·3 "	−134·4	29·8 "	−121·0	50·6 "

Gas	Critical temperature.	Critical pressure.	Boiling point.	Freezing point.	Freezing pressure.	Density of gas.	Density of liquid at boiling point.	Colour of liquid.
	°	atms.	°	°	mm.			
Hydrogen, H_2......	below 220·0	20·0	?	?	?	1·0	?	Colourless.
Nitrogen, N_2	−146·0	35·0	−194·4	−214·0	60	14·0	0·885	"
Carbonic oxide, CO..................	−139·5	35·5	−190·0	−207·0	100	14·0	?	"
Argon, A_1	−121·0	50·6	−186·9	−189·6	?	19·9	about 1·5	"
Oxygen, O_2..........	−118·8	50·8	−182·7	?	?	16·0	1·124	Bluish.
Nitric oxide, NO..	− 93·5	71·2	−153·6	−167·0	138	15·0	?	Colourless.
Methane, CH_4......	− 81·8	54·9	−164·0	−185·8	80	8·0	0·415	"

In order to decide regarding the elementary or compound nature of argon, experiments were made on the velocity of sound in it. From these the ratio of the specific heat at constant pressure to that at constant volume was deduced in the well-known manner. The accuracy of the apparatus used was tested by preliminary observations with air, carbonic anhydride, and hydrogen, which gave results in agreement with those of other observers. Five series of measurements were then made with a sample of gas of density 19·86, and the ratio C_p/C_v of the specific heats found was 1·644. This is practically the theoretical ratio, 1·66, for a monatomic gas, that is, a gas in which all energy imparted to it at constant volume is expended in effecting translational motion. The only other gas of which the ratio of specific heats has been found to fulfil this condition is mercury at a high temperature.

A great number of attempts were made to induce chemical combination with the argon obtained by use of magnesium, but without any positive result. The following substances were tried under different conditions, but without effect:—(*a*) Oxygen in presence of caustic alkali, (*b*) hydrogen, (*c*) chlorine, (*d*) phosphorus, (*e*) sulphur, (*f*) tellurium, (*g*) sodium, (*h*) fused and red-hot caustic soda, (*i*) soda-lime at a red heat, (*j*) fused potassium nitrate, (*k*) sodium peroxide, (*l*) persulphides of sodium and calcium, (*m*) nitro-hydrochloric acid, (*n*) bromine water, (*o*) a mixture of potassium permanganate and hydrochloric acid, (*p*) argon is not absorbed by platinum-black. Argon is, therefore, most astonishingly indifferent, inasmuch as it is not attacked by elements of very opposite character ranging from sodium and magnesium on the one hand, to oxygen, chlorine, and sulphur on the other. It will be necessary to try whether the inability of argon to combine at ordinary or at high temperatures is due to the instability of its possible compounds, except when cold. Mercury vapour at 800° would present a similar instance of passive behaviour.

The authors finally discuss the probable nature of the gas or gases which they have succeeded in separating from atmospheric air, and which has been provisionally named *argon*. It has been shown that argon is present in the atmosphere, and is not manufactured during the process of separation, and it is practically certain that the argon prepared by means of electric sparking with oxygen is identical with argon prepared by means of magnesium. That argon is an element or mixture of elements, may be inferred from the observations on the ratio of the two specific heats. For if argon molecules are di- or polyatomic, the atoms acquire no relative motion, even of rotation, a conclusion improbable in itself and one postulating the sphericity of such complex groups of atoms. But a monatomic gas can be only an element, or a mixture of elements; and hence it follows that argon is not of a compound nature. Argon is approximately 20 times as heavy as hydrogen, that is, its molecular weight is 20 times as great as that of hydrogen, or 40. But its molecule is monatomic, hence its atomic weight, or, if it be a mixture, the mean of the atomic weights of the elements in that mixture, taken for the proportion in which they are present, must be 40. There is evidence both for and against the hypothesis that argon is a mixture; for the present, however, the balance of evidence seems to point to simplicity.

If argon is a single element of the atomic weight 40, no vacant place can be assigned to it in the periodic system, and there is then reason to doubt whether the periodic classification of the elements is complete; whether, in fact, elements may not exist which cannot be fitted among those of which it is composed. On the other hand, if argon is a mixture of two elements, they might find a place in the eighth group, one after chlorine and one after bromine. It would be difficult, however, in this case to account for the heavier element having escaped detection. If it be supposed that argon belongs to the eighth group, then its properties would fit fairly well with what might be anticipated. For the series which contains

$$\mathrm{Si}_n^{\mathrm{IV}},\quad \mathrm{P}_4^{\mathrm{III\ \&\ V}},\quad \mathrm{S}_{8\ \mathrm{to}\ 2}^{\mathrm{II\ to\ VI}},\ \text{and}\ \mathrm{Cl}_2^{\mathrm{I\ to\ VII}},$$

might be expected to end with an element of monatomic molecules of no valency, that is, incapable of forming a compound, or if forming one, being an octad; and it would form a possible transition to potassium, with its monovalence, on the other hand.

As for the physical condition of argon, that of a gas, we possess no knowledge why carbon, with its low atomic weight, should be a solid, while nitrogen is a gas, except in so far as we ascribe molecular complexity to the former and comparative molecular simplicity to the latter. Argon, with its comparatively low density and its molecular simplicity, might well be expected to rank among the gases. And its inertness, which has suggested its name, sufficiently explains why it has not previously been discovered as a constituent of compound bodies.

Assuming provisionally that it is not a mixture, the symbol A is suggested for this element.

In addenda by Ramsay, further determinations of the density of argon are given, the general mean being 19·900. The value of R in the gas equation $R = pv/T$, has been determined between $-89°$ and $+248°$. The numbers show that argon undergoes no molecular change within these limits of temperature. Further determinations of the ratio of the two specific heats were also made, the general mean being 1·643. H. C.

A Singular Case of Metallic Precipitation. By J. B. SENDERENS (*Bull. Soc. Chim.*, 1894, [3], **11**, 424—426; compare Abstr., 1895, ii, 315).—When bright lead is immersed in a solution of lead nitrate containing from 10 to 400 grams per litre, and protected from access of air, metallic lead is gradually precipitated on it in well-defined crystals, just as on iron or zinc. A certain amount of lead nitrite is produced at the same time, and in weaker solutions forms the exclusive product, being deposited in yellow crystals in place of those of the metal.

The lead crystals form plates from 1 to 4 mm. in diameter, and are chemically pure, but they rapidly oxidise in air to the hydroxide, so that a crystallographic examination is impracticable. When kept undisturbed in the original liquid, the metallic crystals are gradually converted into a *basic nitrate*, which crystallises in large, white tufts of silky needles as much as 2 cm. in length.

The precipitation of the lead is not due to local electrolytic action set up by metallic impurities, for precisely the same result is obtained with pure lead made by reducing, by means of sugar-charcoal, litharge prepared from the pure nitrate (compare, however, *loc. cit.*); moreover, the precipitation does not occur in solutions of lead acetate, as would be the case if it were due to this cause. JN. W.

Double Halogen Salts of Ammonium and Copper. By HORACE L. WELLS and E. B. HURLBURT (*Zeit. anorg. Chem.*, 1895, **10**, 157—160, and *Amer. J. Sci.*, 1895, [3], **50**, 390—393).—The *chloride*, $4NH_4Cl,Cu_2Cl_2$, is obtained by cooling a mixed solution of its component salts containing hydrochloric acid, copper wire being placed in the liquid; a large excess of ammonium chloride must be used; it crystallises in colourless prisms, which, on exposure to air, quickly turn brown and then green. The *chloride*, $4NH_4Cl,3Cu_2Cl_2$, is obtained when its component salts are dissolved in the proper proportions in dilute hydrochloric acid; it crystallises in lustrous, colourless dodecahedra, and is fairly stable on exposure to air, but gradually turns green.

The *bromide*, $4NH_4Br,Cu_2Br_2$, obtained in a similar way to the corresponding chloride, crystallises in long, colourless prisms, and is much more stable than the corresponding chloride; on exposure to air, it gradually turns green. The *bromide*, $2NH_4Br,Cu_2Br_2 + H_2O$, is obtained if an excess of cuprous bromide is present; it crystallises in lustrous, colourless rhombohedra, and is more stable than the preceding salt.

The *iodide*, $2NH_4I,Cu_2I_2$, is the only salt obtained even when the components are employed in very different proportions.

E. C. R.

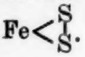
Formation of Nickel Carbonyl. By HG. FREY (*Ber.*, 1895, **28**, 2512—2514).—Sodium decomposes ethylic oxalate into ethylic carbonate and carbonic oxide. When ethylic oxalate is added to finely divided nickel chloride and sodium, suspended in light petroleum, traces of nickel carbonyl are found in the gas which is evolved, but the amount present is so small that no liquid can be obtained.

Ferric chloride, when treated in the same way, gave no trace of iron carbonyl. A. H.

Double Salts of Cæsium Chloride with Chromium Trichloride and Uranyl Chloride. By HORACE L. WELLS and B. B. BOLTWOOD (*Zeit. anorg. Chem.*, 1895, **10**, 181—184; also *Amer. J. Sci.*, 1895, [3], **50**, 254—258).—The *chloride*, $2CsCl,CrCl_3 + H_2O$, is obtained by saturating warm solutions of its component salts with hydrogen chloride, and corresponds with the double chlorides prepared by Neumann (Abstr., 1888, 655). It crystallises in aggregates of small, reddish-violet crystals, is stable on exposure to air, does not give up its water of crystallisation at 100°, and dissolves slowly in water forming a green solution. The *chloride*, $2CsCl,CrCl_3 + 4H_2O$, is obtained from a cold solution of its components by saturating it with hydrogen chloride, or by evaporation over sulphuric acid; it crystallises in green, monoclinic crystals, is somewhat hygroscopic, very easily soluble in water, and when heated at 110° loses $3H_2O$, and is converted into the above violet salt. The authors point out that whereas green chromium sulphate contains less water than the violet modification, the reverse is the case with the double cæsium salts, and that therefore probably the green colour of the salts is not due to the formation of basic salts and free acid, or of acid salts.

The *chloride*, $2CsCl,UO_2Cl_2$, prepared in a similar way to the above, corresponds with the double salts already described; it crystallises in beautiful yellow, rhombic leaflets. E. C. R.

Chemical Behaviour of Pyrites and Marcasite. By Amos P. Brown (*Proc. Amer. Phil. Soc.*, 1894, **33**, 225—243). See Abstr., 1895, ii, 316.—The constitution here deduced for marcasite is the same as that given by Loczka (Abstr., 1895, ii, 20) for pyrites, namely,



L. J. S.

Mineralogical Chemistry.

A Graphitic Schist from Co. Donegal. By Richard J. Moss (*Scient. Proc. Roy. Dublin Soc.*, 1893, **8**, N.S., 206—207).—A graphitic schist from Glendown, Letterkenny, with a lustre like graphite, but of a grayish tint, gave on analysis

H_2O (at 100°).	H_2O (on ignition).	C.	S.	Ash (less O for S).	Total.	Sp. gr.
0·98	3·68	3·15	4·03	87·89	99·73	2·662

The ash gave, together with traces of manganese and nickel,

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	Total.
58·91	19·87	7·40	4·86	1·63	3·54	3·73	99·94

L. J. S.

Wurtzite from Mies, Bohemia. By Friedrich Becke (*Tsch. Min. Mitth.*, 1894, **14**, 278—279).—Botryoidal and stalactitic schalenblende from near Mies, gave on analysis (by Heinisch)

S.	Zn.	Cd.	Fe.	Gangue.	Total.	Sp. gr.
30·23	65·84	1·02	0·45	1·11	98·65	3·672

This deficiency of about 1½ per cent. is also to be noticed in the previous analysis by Gerstendörfer (*Ber. Akad. Wien*, **99**). In the above analysis, the atomic ratio Zn, &c. : S = 1·030 : 0·945, and for the excess of zinc, &c., is calculated 1·36 per cent. of oxygen; this would correspond with a mixture of 39·9 per cent. of voltzite (Zn_5S_4O), and 60·1 per cent of wurtzite. Under the microscope, however, there is no indication of such a mixture, and the substance consists of fibres giving straight extinction, and with positive double refraction. L. J. S.

Artificial Cinnabar. By J. A. Ippen (*Tsch. Min. Mitth.*, 1894, **14**, 114—120).—Powdered cinnabar heated with sodium sulphide in a sealed tube at 80°, gave crystals of cinnabar, and also a black deposit containing small, black crystals of cinnabar. In another experiment, where black precipitated mercuric sulphide was exposed to sunlight for two months in a sealed tube with sodium sulphide, the temperature never exceeding 45°, small, well-developed crystals of cinnabar were formed; with hydrochloric acid under the same conditions no cinnabar was formed. Cinnabar is shown to be slightly soluble in sodium carbonate solution. L. J. S.

Nickeliferous Pyrites. By WILLIAM L. GOODWIN (*Canadian Rec. Sci.*, 1893, **5**, 346—347).—In the Murray mine, Sudbury, Ontario, are grey nodules of a nickel ore resembling mispickel in colour and appearance. Analysis gave

Fe.	Ni (and Co?).	S.	Insol.	Total.
37·45	4·82	44·26	9·92	96·45

Calculated to FeS_2 and NiS_2, the analysis shows an excess of 3·33 per cent. of iron, which is accounted for by the presence of the associated magnetite, pyrrhotite, and hornblendic matrix. L. J. S.

Skleroklase (Sartorite) from Binn. By HEINRICH BAUMHAUER (*Ber. Akad. Berlin*, 1895, 243—252).—The results of the measurement of four crystals from the Binnenthal are given, numerous new forms being noted. Analysis of one small crystal gave

S.	Pb.	As.	Total.	Sp. gr.
25·26	46·08	26·28	97·62	5·05

The formula deduced is $3(PbS,As_2S_3) + 2PbS,As_2S_3$, this being near to von Waltershausen's formula in which there is 3·124, instead of 3 of the first molecule. vom Rath's formula, PbS,As_2S_3, is the one usually accepted. L. J. S.

Safflorite from Nordmark, Sweden. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 68—71).—This mineral occurs at the Kogrufva, in a dolomitic calcite, and associated with chondrodite, tremolite and blende. It is tin-white, and usually massive, but sometimes in crystals; the crystallographic constants, which have not before been determined for this mineral, are given. Sp. gr. 7·41. Analysis by Mauzelius gave

Fe.	Co.	Ni.	As.	S.	Pb(+Cu).	Total.
15·28	12·99	0·20	71·13	0·68	0·33	100·61

This gives the formula $(Fe,Co)As_2$, or nearly $FeAs_2,CoAs_2$. Although the composition is half way between that of safflorite and löllingite, the author considers this mineral to belong to the former, as the crystals differ from those of the latter. L. J. S.

Fiorite. By AUGUSTIN A. DAMOUR (*Bull. Soc. fran. Min.*, 1894, **17**, 151—153).—This opal, from Fiora, Tuscany, is either white and translucent, with a satiny and pearly lustre (Analysis I), or white and opaque (II). On heating, it gives off acid water, which etches glass; when powdered and moistened it also gives an acid reaction.

Both before and after ignition, it is almost wholly dissolved by caustic potash.

	SiO_2.	H_2O and SiF_4. (Loss on ignition).	Al_2O_3 and Fe_2O_3.	Total.	Sp. gr.
I.	96·70	2·90	0·40	100·00	2·17
II.	96·59	3·10	0·31	100·00	2·19

This suggests that fiorite has been formed by the action of water on silicon fluoride, some hydrogen silicofluoride being enclosed in the separated silica. L. J. S.

Artificial Martite. By CHARLES FRIEDEL (*Bull. Soc. fran. Min.*, 1894, **17**, 150—151).—Martite is now usually considered to be hæmatite pseudomorphous after magnetite. On heating crystals of magnetite, weighing 0·4499 gram, over the blowpipe for four or five hours, there was a gain in weight of 0·0158 gram (calculated for change from Fe_3O_4 to Fe_2O_3 = 0·0155). By this treatment, the crystals have lost their magnetic properties, but are only slightly changed in outward aspect, having become slightly rough on the surface, and of a gray colour. The material has therefore been transformed from magnetite to hæmatite. L. J. S.

Pyroaurite from the Mossgrufva, Nordmark, Sweden. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 59—63).—Pyroaurite occurs in the manganiferous dolomite of this mine as thin, yellow to yellowish-brown, crystalline scales with a round or hexagonal outline. The crystal angles are near to those of chalcophanite, but the crystals are hexagonal with pyramidal hexahedrism; optically uniaxial, with optical anomalies. On heating, the mineral is infusible, and retains its yellow colour; after ignition, it is strongly magnetic, before, only slightly so; sp. gr. 2·07; analysis by Mauzelius, on a small amount of material dried at 108°, gave

Fe_2O_3.	MnO.	MgO.	H_2O.	Insol.	Total.
22·0	4·5	34·8	36·1	0·5	97·9

This agrees nearly with the pyroaurite formula, with part of the Mg replaced by Mn, namely, $Fe_2O_3,6(Mg,Mn)O,15H_2O$; some of the iron may be ferrous. L. J. S.

Artificial Crystallised Carbonates. By LÉON BOURGEOIS (*Bull. Soc. fran. Min.*, 1894, **17**, 79—81).—The author points out that his humid methods for producing crystallised carbonates, such as calcite, strontianite, &c. (Abstr., 1887, 221), are identical with those of Bunsen (*Annalen*, 1847, **65**, 71). L. J. S.

Fluid Enclosures in Gypsum. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1893, **1**, 277—281, and *Geol. För. Förh.*, 1893, **15**, 136).—In large crystals of gypsum from Girgenti, Sicily, large fluid enclosures were present; from the largest cavity, 3 c.c. of a neutral liquid were obtained, hydrogen sulphide escaping from the cavity at not very great pressure. The liquid contained 4·02 per cent. of solids, which had the composition (anal. by Mauzelius)

K_2SO_4.	Na_2SO_4.	$CuSO_4$.	NaCl.	$MgCl_2$.
3·7	11·4	9·7	66·2	9·0

This is compared with sea water and with the water of the Kaiserquelle at Aix-la-Chapelle.

Two views have been put forward to account for the origin of the sulphur of the Sicilian deposits: one supposes it to have been formed by the reducing action of organic matter on gypsum in isolated lagoons; the other, that it has been deposited with the gypsum from spring waters containing hydrogen sulphide; the latter view is supported by the above analysis. L. J. S.

Artificial Anhydrite. By Reinhard Brauns (*Jahrb. f. Min.*, 1894, ii, 257—264).—Anhydrite has been artificially formed by fusing together calcium sulphate and chloride, and by heating gypsum in sealed tubes with chlorides, or by digesting it with hot sodium chloride solution; these processes would, however, not account for the formation of the large beds of anhydrite found in nature.

In the author's experiments, a large drop of a saturated solution of sodium and potassium chlorides is placed on a microscope slide, at its side a drop of calcium chloride solution, and, opposite this, a drop of magnesium sulphate solution; the two drops are then brought into contact by a narrow path, and allowed to evaporate. As diffusion takes place, small prisms of anhydrite are deposited, and, here and there, gypsum. On removing the salt crystals and adding water, the anhydrite crystals are immediately corroded, and gradually disappear, and, on allowing this mixture to evaporate, gypsum, and not anhydrite, crystals are formed. In case the amount of water added is not enough to completely dissolve the anhydrite, gypsum crystals are deposited around the corroded forms; or sometimes, when the gypsum crystals do not grow on the surface of the anhydrite, but near to it, they may be seen to grow at the expense of the anhydrite.

Calcium sulphate is, therefore, one of those substances which crystallise from saline solutions in compounds poor in water, such solutions having the same effect as an increase in temperature. Instances of a relation similar to that of gypsum and anhydrite, are epsomite and kieserite, and glauberite and thenardite; moreover, the second members of each of these pairs crystallise together in nature from saline solutions. L. J. S.

Serpierite, Lautite, and Pseudobrookite. By August Frenzel (*Tsch. Min. Mitth.*, 1894, **14**, 121—130).—*Serpierite.*—This mineral, which occurs at Laurion, Greece, in bushy groups of blue, orthorhombic crystals, has not before been analysed. Sp. gr. 2·52; analysis gave

CuO.	ZnO.	CaO.	SO_3.	H_2O.	Total.
36·12	13·95	8·00	24·29	16·75	99·11

Formula: $3(CuO,ZnO,CaO),SO_3 + 3H_2O$. At 100° 1·26 per cent. of water is given off; at 285° the powdered mineral becomes black.

Lautite.—A new find of this mineral has been made at the old locality, Lauta, Marienberg, Saxony; it occurs as radiating aggregates, and, from its appearance, it cannot be a mixture, as has been supposed. Analysis gave

Cu.	As.	S.	Total.	Sp. gr.
36·10	45·66	17·88	99·64	4·91

This leads to the formula previously adopted by Frenzel, namely, CuAsS. Some of the previous analyses show 12 per cent. of silver.

Pseudobrookite.—The formula which has been derived for the natural mineral is $2Fe_2O_3,3TiO_2$; but to the artificial mineral has been given the formula, Fe_2O_3,TiO_2 (Abstr., 1893, ii, 18). Analysis of the material from the original locality, Aranyer Berg, Transylvania, gave (Frenzel) I and (Traube) II.

	TiO_2.	Fe_2O_3.	MgO.	SiO_2.	Total.
I.	41·27	54·24	2·09	1·66	99·26
II.	41·46	56·45	1·0	1·29	100·20

Deducting magnesia and silica as representing admixed szaboite, these analyses give the formula $2Fe_2O_3,3TiO_2$. Experiments of Traube's are given by which he tested the methods of separating TiO_2 and Fe_2O_3. L. J. S.

Hautefeuillite, a New Mineral from Bamle, Norway. By LÉOPOLD MICHEL (*Bull. Soc. fran. Min.*, 1893, **16**, 38—40).—In the greyish apatite veins in the gabbro of Odegärden, are greenish nodules consisting of a mixture of wagnerite and apatite, in which the new mineral was found together with crystals of apatite, pyrites and monazite. The colourless, transparent, monosymmetric crystals form lamellar and radial aggregates: cleavage parallel to the plane of symmetry perfect; sp. gr. 2·435; plane of the optic axes parallel to the plane of symmetry, 2E about 88°, 2V = 54° 23′ for yellow light. Analysis gave

P_2O_5.	MgO.	CaO.	H_2O.	Total.
34·52	25·12	5·71	34·27	99·62

This gives the formula $(Mg,Ca)_3(PO_4)_2 + 8H_2O$. The mineral differs from bobierrite in containing calcium, and in the optical characters.

L. J. S.

Caryinite. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 113—118).—The only previous analysis of this mineral has been shown to have been made on impure material, the specimens having been mixed with calcite and berzeliite, into the latter of which caryinite is readily altered. A new find of the mineral at the old locality, Långban, Sweden, has rendered it possible to analyse pure, fresh material, and to determine, by means of the cleavage and optical characters, that the mineral is orthorhombic. The massive, nut-brown mineral occurs in fissures with schefferite, rhodonite and hedyphane; sp. gr. 4·29; analysis by Mauzelius, on material dried at 110°, gave

As_2O_5.	P_2O_5.	PbO.	FeO.	MnO.	MgO.	BaO.	CaO.
49·78	0·19	9·21	0·54	18·66	3·09	1·03	12·12

K_2O.	Na_2O.	H_2O.	Total.
0·37	5·16	0·53	100·68

Also traces of V_2O_5(?) and Cl. If the water exists with the bases as H_2, the formula deduced is $10RO,3As_2O_5$; if, however, it exists in the group $2(HO—R'')$ the formula is $3RO,As_2O_5$. The original analysis of this mineral showed neither alkalis nor water. Compare soda-berzeliite below. L. J. S.

Soda-berzeliite from Långban, Sweden. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 118—121).—This new variety of berzeliite differs from berzeliite in outward appearance by its orange-yellow to fire-red colour; it is usually massive, but sometimes occurs as crystals (icositetrahedra). Sp. gr. 4·21. Analysis by Mauzelius gave

As_2O_5.	V_2O_5.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
52·90	0·24	0·38	21·41	18·34	0·72	0·09	5·05	0·40	99·53

together with traces of Sb_2O_5 and Cl, and about $\frac{1}{2}$ per cent. of insoluble matter. This analysis is very similar to that of caryinite (see preceding abstract), and in the same manner according as the water is assumed to be combined with the acids or the bases the formula deduced is $10RO,3As_2O_5$, or $3RO,As_2O_5$ respectively. As these two minerals differ crystallographically, berzeliite being cubic and caryinite orthorhombic, they may have different formulæ ($10RO,3As_2O_5$ and $3RO,As_2O_5$), or they may have the same formula and be dimorphous, or thirdly the presence of lead in caryinite may be essential.

Igelström's pyrrhoarsenite (Abstr., 1895, ii, 76) resembles soda-berzeliite in some respects. L. J. S.

Långbanite from the Sjögrufva, Sweden. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, 2, 96—97).—This mineral, before only known from the Långban mines, has been found at the Sjö mine in a mixture of rhodonite, manganophyllite, braunite and calcite; it is generally in lamellar masses, but sometimes shows hexagonal outlines and a distinct basal cleavage. In very thin splinters, it is sub-translucent with a red colour; sp. gr. 4·60. Analysis by Mauzelius gave

Sb_2O_3.	Fe_2O_3.	SiO_2.	MnO_2.	MnO.	CaO.	MgO.	H_2O.	Total.	O.
12·51	13·98	12·82	24·36	32·22	2·40	1·11	0·52	99·92	3·09

This gives the ratio $Sb_2O_3 : Fe_2O_3 : RO_2 : RO = 0·087 : 0·177 : 1 : 1·07$. As before (Abstr., 1893, ii, 421) the oxides $R''O$ and $R^{iv}O_2$ may be brought together as R'''_2O_3, and the substances considered as an isomorphous mixture of the three groups in the formula $mSb_2O_3 + nFe_2O_3 + pR''R^{iv}O_3$, where, in this case $m : n : p = 10 : 20 : 115$. The fairly constant amount of Sb_2O_3 shown in previous analyses would, however, tell against this improbable isomorphous mixture. The mineral here analysed closely resembles in appearance and composition Sjögren's B type of långbanite from Långban, and may be represented by the empirical formula $Sb_2O_3,9Mn_2O_3,5MnSiO_3$, whilst the A type from Långban may be represented by

$$Sb_2O_3,10Mn_2O_3,3MnSiO_3,$$

where Mn_2O_3 is partly replaced by Fe_2O_3, and $MnSiO_3$ by $CaSiO_3$ and $MgSiO_3$. L. J. S.

Apophyllite from Algeria. By LOUIS GENTIL (*Bull. Soc. fran. Min.*, 1894, **17**, 11—28).—In an altered andesite at Bou Serdoun, Collo, are cavities, containing apophyllite and other minerals. The crystals show optical anomalies; analyses gave

SiO_2.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.	Sp. gr.
52·32	25·30	0·57	4·83	0·80	16·66	100·48	2·372

At 100° there is a loss of 0·33 per cent. of water; fluorine was absent (Abstr., 1894, ii, 421). The associated minerals and the rock are described at length. L. J. S.

Prolectite, a New Mineral of the Humite Group. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 99—105).—Two fragments of crystals from Nordmark, Sweden, were found to differ from the other brownish-grey humite minerals of the same locality in their crystal angles and optical characters: the crystallographic constants are approximately $a:b:c = 1·0803:1:1·8862$; $\beta = 90°$; the vertical axis (c) is, therefore, one-third of that of clinohumite. Penfield and Howe (Abstr., 1894, ii, 241) have predicted the existence of a member of the humite group having the composition

$$Mg[Mg(F,OH)]_2SiO_4,$$

and the axial ratios $a:b:c = 1·086:1:1·887$; $\beta = 90°$. Owing to lack of material, the mineral has not been analysed. L. J. S.

Composition of Chondrodite, Humite and Clinohumite, from Nordmark. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 39—54).—In a previous paper (*Bull. Geol. Inst., Upsala*, 1892, **1**, 16—40) are given the results of the crystallographic and optical measurements of these minerals from a new locality, the Kogrufva, Sweden; the mode of occurrence and associations are strikingly similar to those at the Tilly Foster Iron Mine, N.Y. Seven duplicate analyses by R. Mauzelius, lead to the same formulæ as those given by Penfield and Howe (Abstr., 1894, ii, 241). Potassium, sodium, and titanium were found in small quantities, and there is a slight variation in the amount of water shown in the analyses, owing, when too high, to the partial alteration of the mineral to serpentine, and, when too low, to the difficulty of driving off all the water. The ratio of F : OH was always about 1 : 1. On heating chondrodite in dry hydrogen chloride (Clarke's method), the amount of magnesium rendered soluble, agreed with that required by the assumption of the existence of the group MgOH. Structural formulæ showing the relation to olivine are given. L. J. S.

Soda-richterite from Långban, Sweden. By S. A. HJALMAR SJÖGREN (*Bull. Geol. Inst., Upsala*, 1894, **2**, 71—77).—This mineral occurs with rhodonite in rather coarsely crystalline, columnar aggregates of an azure-blue or gray to grayish-violet colour. The cleavage angle of 56° 27′, and the optical characters show it to belong to the hornblende group. I gives the analysis by Mauzelius of the blue variety, sp. gr. 3·05, and II of the grayish-violet, sp. gr. 3·10.

	SiO_2.	FeO.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	F.	Total. (less O for F).
I.	56·25	0·15	6·49	5·44	21·89	1·60	6·17	1·56	0·15	99·64
II.	54·76	0·21	12·71	5·83	17·82	1·65	4·02	2·77	0·09	99·82

Calculating the water, which only goes off at a high temperature, as H_2 with the metals, the analyses reduce to the metasilicate formula. A sample of the blue variety lost 3·37 per cent. on ignition, and from the powder was extracted by soda solution 13·38 per cent. of SiO_2, this corresponding with 3·99 per cent. of water in H_2SiO_3. The above analyses do not reduce to the formula, $CaMg_3Si_4O_{12}$, sometimes given for non-aluminous amphiboles.

The original richterite of Breithaupt is shown to have been wrongly described. L. J. S.

New Analyses of Chloromelanite. By Augustin A. Damour (*Bull. Soc. fran. Min.*, 1893, **16**, 57—59).—Several ancient stone axes with a density varying from 3·55 to 3·60 were seen to contain varying amounts of garnet in the dark green matrix; the latter, on being separated, gave the following analyses.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	Total.	Sp. gr.
Mexico....	56·57	17·21	8·86	4·44	2·12	10·70	99·90	3·37
Antioch....	55·01	9·99	10·09	12·00	5·23	7·48	99·80	3·36
Lyons.....	56·00	13·19	13·90	3·71	1·88	10·75	99·43	3·43
Carcassonne	57·75	14·85	9·52	3·15	1·81	11·76	98·87	3·40

Chloromelanite may be considered to be a ferruginous jadeite; both these minerals, after fusion, are decomposed by hot hydrochloric acid without gelatinisation. The association of garnet with chloromelanite constitutes a rock resembling eclogite. L. J. S.

Andradite Garnet from Algeria. By Louis Gentil (*Bull. Soc. fran. Min.*, 1894, **17**, 269—272).—This garnet occurs near Cape Bou-Garoune, Constantine, in a vein of hæmatite and quartz with ilvaite, limestone, green pyroxene, and perhaps bustamite. The small dodecahedral crystals are yellowish to dark brown, and show optical anomalies. It is easily attacked by hot, strong hydrochloric acid; analysis gave

SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	Mn.	MgO.	K_2O.	Total.
36·03	30·94	0·27	32·58	trace	0·48	0·17	100·47

This gives the usual formula $3CaO,Fe_2O_3,3SiO_2$. On ignition, there is a loss of 1·60 per cent., probably due to reduction.

L. J. S.

Artificial Ægirine. By Helge Bäckström (*Bull. Soc. fran. Min.*, 1893, **16**, 130—133).—A leucite-phonolite rich in haüyne was fused and allowed to cool slowly for three days; the colourless glass thus produced contained microlites of oligoclase and nepheline, and numerous crystals of a yellow pyroxene, which agree in their optical characters with ægirine. A mixture of quartz, ferric oxide, and sodium carbonate, in the proportions given by the ægirine formula, when treated in the same way, gave a mass largely consisting of prismatic crystals of ægirine, with some yellow glass, hæmatite scales, and probably felspar. L. J. S.

Composition of Canadian Limestones and Dolomites. By Bernard J. Harrington (*Canadian Rec. Sci.*, 1894, **6**, 27—32).—The author gives analyses of 18 limestones and dolomites from various geological horizons in Canada. L. J. S.

Process of formation of Dolomitic Rock. By Constantin Klement (*Bull. Soc. Belge Geol.*, 1895, **9**, 3—23, and *Tsch. Min. Mitth.*, 1895, **14**, 526—544).—After reviewing the different theories of the origin of dolomite, the author points out that dolomite deposits are often in the form of coral reefs, and that corals consist of aragonite. His experiments show that solutions of magnesium salts act much more readily on aragonite than on calcite. When powdered aragonite (crystals, corals, and artificial) is warmed with magnesium sulphate in a concentrated solution of sodium chloride, the action begins at about 60°, and increases with the temperature, until at 91° there is a maximum yield of about 42 per cent. of magnesium carbonate. Experiments were made with solutions of different concentrations, and of different salts. It is shown, by the action of dilute acids, that the product formed consists of a mechanical mixture of calcium and magnesium carbonates; but owing to the tendency of dolomite to crystallise, such a mixture would be gradually converted into dolomite. The conditions of these experiments would be those which exist in the isolated lagoons of coral islands.

L. J. S.

Lower Carboniferous Volcanic Rocks of East Lothian. By Frederick H. Hatch (*Trans. Roy. Soc., Edin.*, 1893, **37**, 115—126).—Several analyses are given of the lower, basic lavas (basalts free from felspar), of the upper, more acid lavas (trachytes), and of the material filling the volcanic vents; all being of lower carboniferous age. I is of the limburgite of Whitelaw Hill; it is composed of olivine, augite, magnetite, glassy matter, and probably nepheline; sp. gr. 3·03. II is of the phonolite of the volcanic vent of Traprain Law; this consists of sanidine, nepheline, and green soda-augite, the nepheline being largely converted into zeolites; sp. gr. 2·588.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.
I.	40·2	2·9	12·8	4·0	10·4	—	10·4	11·9
II.	56·8	0·5	19·7	2·2	3·5	0·2	2·2	0·4

	Na_2O.	K_2O.	Loss on ignition.	Total.
I.	2·7	0·8	3·4	99·5
II.	4·3	7·1	2·5	99·4

Limburgite has not before been recorded in the British Isles, and phonolite only at the Wolf Rock. L. J. S.

Borolanite, an Igneous Rock. By J. J. Harris Teall and John Horne (*Trans. Roy. Soc., Edin.*, 1893, **37**, 163—178).—This intrusive, igneous rock, from near Loch Borolan in Sutherland, consists principally of orthoclase and melanite garnet, with plagioclase, pyroxene, biotite, and alteration products of nepheline; it is thus related to the elæolite-syenites. I gives a bulk analysis of the rock, and II the portion soluble in hydrochloric acid. III is of a peculiar blue substance which is decomposed by acids, and is probably the alteration product of a member of the sodalite group.

	SiO_2.	TiO_2.	SO_3.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	BaO.	CaO.
I.	47·8	0·7	0·4	20·1	6·7	0·8	0·5	0·8	5·4
II.	69·3	—	—	16·8			—	—	3·9
III.	36·1	—	5·9	28·4	—	—	—	—	3·2

	MgO.	Na_2O.	K_2O.	Loss on ignition.	Total.
I.	1·1	5·5	7·1	2·4	99·3
II.	0·3	4·6	1·7	2·4	99·0
III.	—	16·2	1·8	—	91·6

L. J. S.

Analyses of Augite and Nepheline-leucite-tephrite from Bohemia. By J. E. Hibsch (*Tsch. Min. Mitth.*, 1894, **14**, 95—113).—Fourteen analyses of various igneous rocks from the Bohemian Mittelgebirge are given. I is of a nepheline-leucite-tephrite from Falkenberg, and II of the large augite crystals of the same rock; both analysed by F. Pfohl.

	SiO_2.	TiO_2.	P_2O_5.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.
I.	47·83	2·27	1·33	16·09	4·32	3·62	trace	10·68
II.	45·67	0·62	—	9·04	7·46	2·00	—	21·78

	MgO.	K_2O.	Na_2O.	H_2O (combined).	Moisture.	Total.	Sp. gr.
I.	5·53	4·05	4·46	0·24	0·05	100·47	2·858
II.	12·09	0·56	1·25	0·31	—	100·78	3·37

The spectroscope showed Sr and Li in I. L. J. S.

Argon and Helium in Mineral Waters. By Ch. Bouchard (*Compt. rend.*, 1895, **121**, 392—394).—The gas evolved from the sulphur waters of the Pyrenees consists mainly of nitrogen. The gas from the spring at Raillère, however, contains argon and helium, and that from the two springs at Bois contains helium, and apparently another element also, the spectrum of which is characterised by red and orange-red lines. C. H. B.

Composition of Water of the Pacific. By Camille Chabrié (*Bull. Soc. fran. Min.*, 1894, **17**, 220—222).—A sample of water taken from the surface of the Pacific at "latitude 12 hours north of Paris," contained, in a litre, 24·27 grams of chlorine and 3·056 grams of SO_4. Bromine and iodine are absent or present only in traces. The water is neutral, and has a sp. gr. of 1·028 at 26°. The amount of chlorine in this water is greater than that in the water of other oceans.

L. J. S.

Physiological Chemistry.

Respiratory Metabolism. By WILHELM FILEHNE and H. KIONKA (*Pflüger's Archiv*, 1895, **92**, 201—248).—Geppert and Zuntz (*ibid.*, **42**, 189) have shown that during muscular work, in spite of the increased respiratory exchange, the blood gases remain practically unaltered. They consider that this constancy is regulated by nervous action, and one of the questions investigated in the present research is the discovery of the nerve channels, and the results of dividing them. Rabbits and dogs were used; muscles were thrown into tetanus by electrical stimulation, and the expired air and blood gases analysed by Zuntz's methods. Observations are also recorded on body weight and temperature.

The result of cutting the nerves of the tetanised muscles is that muscular work causes a fall in the amount of oxygen in the aortic blood; there is also a small diminution in the amount of carbonic anhydride. But when the vagi are also divided, there is a marked rise in the latter gas, and a fall in the amount of oxygen; the vagi are supposed to be the chief nervous channels in question, experiments leading to the conclusions that it is on the vagal terminations in the lungs that the venous blood specially acts, and thus secondarily on the respiratory centre, and further that the diminution of oxygen is a more important factor in exciting dyspnœic symptoms than increase of carbonic anhydride. On the other hand, it appears to be the increase of carbonic anhydride in the muscular substance which excites the sensory nerves of muscle, and so reflexly influences the respiratory mechanism.

The question of dyspnœa due to work is discussed at length; other subjects treated are Cheyne-Stokes respirations, and the very similar periodicity of respiratory activity occurring in morphine poisoning.

The blood gases and respiratory activity appear to bear no constant relationship to each other; thus the animal may breathe when the arterial blood has much oxygen and little carbonic anhydride, and the pauses may occur when the opposite condition of the blood gases is present. Fatigue of the respiratory centre is also dismissed as an explanation of the phenomena; the real explanation is left an unsettled problem.

W. D. H.

Action of Salts on the Gastric Digestion of Fibrin, and of Acids on the Saline Digestion of Fibrin. By A. DASTRE (*Compt. rend. Soc. Biol.*, 1894, 778—779; compare Abstr., 1895, ii, 300).—The proteolytic action of acidified pepsin is prevented by concentrated salts like sodium or ammonium chloride: the proteolytic action of concentrated saline solutions is prevented by acidification.

W. D. H.

Oxidising Power of the Blood. By J. E. Abelous and G. Biarnès (*Compt. rend. Soc. Biol.*, 1894, 536—538, 799—801).—Salicylaldehyde is not oxidised to salicylic acid by the air, or by distilled water, or physiological saline solution at 37°. The acid is, however, formed when defibrinated blood or serum is added at this temperature, although this does not occur at the temperature of the air. The amount of oxidation varies with the blood of different animals, and is attributed to a specific ferment, which is destroyed by boiling. Certain organs (testis, thyroid, adrenals, thymus, kidney, liver, lung, and spleen) possess the same power, which is lost when vitality is destroyed; it is not shown by muscles, brain, or pancreas.

W. D. H.

Action of Blood-serum on Glycogen and on Maltose. By Émile E. Bourquelot and Eugène Gley (*Compt. rend. Soc. Biol.*, 1895, 247—250).—Blood serum has a saccharifying action on glycogen, the action being more energetic than that of saliva; the sugar formed is not, however, maltose but dextrose. W. D. H.

Formation of Glycogen in the Animal Organism. By Maurice Kaufmann (*Compt. rend. Soc. Biol.*, 1895, 277—280), and by A. Dastre (*ibid.*, 280—283).—The first paper discusses the origin of glycogen: the author believes that in man and the higher animals, it originates solely in the liver, and that the glycogen in the blood and elsewhere is derived from the liver, and not formed in the cells where it can be detected.

The second paper discusses the same question with the opposite conclusion, maintaining the doctrine that glycogen is fixed, not circulating. W. D. H.

Glycogen in Lymph. By A. Dastre (*Compt. rend. Soc. Biol.*, 1895, 242—247).—Lymph contains 0·097 part of glycogen per 1000. After 24 hours, it is destroyed in the lymph by a diastatic ferment. Glycogen is present in the cells, but not in the plasma.

W. D. H.

Thyreo-antitoxin. By Sigmund Fränkel (*Wiener med. Blätter*, 1895, No. 48).—After removal of proteïd and gelatinous matter from thyroid extract, the physiological substance which possesses curative powers remains unprecipitated, and so far as experiments have gone as yet, is identical with a substance of the formula $C_6H_{11}N_3O_5$, called provisionally, *thyreo-antitoxin*, which can be crystallised out by concentration; it is very hygroscopic. It produces rapidity of pulse, but no fall of blood pressure, and when administered to animals deprived of their thyroids it delays the onset of death, and abolishes the nervous symptoms; it does not, however, prevent death.

W. D. H.

Uropoïetic Diastase. By Ch. Richet (*Compt. rend. Soc. Biol.*, 1894, 525—528).—The alcoholic precipitate of extract of liver contains two ferments, the activity of which is destroyed by boiling; when added to liver extracts, the changes produced are a diminution of glycogen, and an increase of urea. W. D. H.

Composition of the Milk of Various Animals. By AUGUSTO PIZZI (*Staz. Sper. Agrar.*, 1894, **26**, 615—639).—The volatile, fatty acids of milk from various sources, and the points of fusion and solidification of the butter were determined with the following results.

	Wollny number.	M. p. of butter.	Solidification of butter.
Woman	1·42	32·0°	22·5°
Goat	28·60	36·5	31·0
Sheep	32·89	29·0	12·0
Buffalo	26·18	38·0	29·0
Sow	1·65	28·0	12·0

The Wollny numbers are also given for the following butters: Mare's, 11·22; ass, 13·09; rabbit, 16·06; bitch, 1·21; cat, 4·40; and rat, 2·97. The odour, colour, and taste, &c., of the butter are described.

The following percentage results were obtained with the milk of (1) sheep, (2) goats from the Appenines, (3) buffalos, and (4) rabbits.

	Sp. gr. at 15°.	Water.	Fat.	Albumin and caseïn.	Lactose.	Ash.
1.	1·0413	80·425	9·66	4·44	4·37	1·10
2.	1·0326	86·75	5·35	3·64	3·60	0·66
3.	1·0332	82·20	7·95	4·13	4·75	0·97
4.	1·0493	69·50	10·45	15·54	1·95	2·56

Determinations of volatile fatty acids in the colostrum obtained from cows at successive periods, showed increased amounts as the conversion into normal milk proceeds. N. H. J. M.

Sterilisation of Milk and the Lactic Fermentation. By PAUL CAZENEUVE (*Bull. Soc. Chim.*, 1895, [3], **13**, 502—509).—The milk is sterilised by heating it in boiling water in screw-stoppered bottles, which are capsuled with tin, and completely immersed in the water, the air escaping through capillary orifices in the capsules subsequently closed by compression. As the bottles cool, the capsules and necks are coated with solid paraffin to eliminate all possibility of the entrance of air.

Of the various samples of milk subjected to this treatment, some fresh, some about to turn sour, and some actually putrescent, none underwent further change—even when kept for days at 35°. The lactic ferment seems to be attenuated and, to a large extent, destroyed by the process, for the sterilised samples remained for the most part unchanged after the admission of sterilised air, and did not give rise to colonies when sown in a gelatin medium.

Milk thus treated is stated to be more digestible than new milk, and has not the objectionable colour or taste of milk boiled in an open vessel, or that sterilised at higher temperatures. The process has been tried on the commercial scale. JN. W.

Proteïds of Normal Urine. By KARL A. H. MÖRNER (*Skand. Archiv Physiol.*, 1895, 332—437).—Although healthy human urine for-practical purposes contains no proteïd, yet there is proteïd matter present in extremely small quantities. For the purpose of ascertaining its nature, each experiment required many litres, often 80 or 90 litres of urine. This proteïd or proteïd-like material is contained partly in suspension in the ordinary mucous cloud or nubecula, and partly in solution. The research naturally, therefore, divides itself into two parts. The conclusions drawn in reference to the nubecula are the following.

The sediment of normal urine contains a specific member of the mucin group, named *urine-mucoid*, which probably originates from the mucous membrane of the urinary passages. It has the percentage composition: C, 49·4, N, 12·74, S, 2·3, and is readily soluble in ammonia. From its solutions, it is precipitable by acetic and other acids, and is only slightly soluble in excess of the acid. Its solution is lævorotatory ($\alpha_D = -62—67°$), and it reduces alkaline copper solution slightly; after boiling with hydrochloric acid, however, it is strongly reducing. It gives the proteïd colour-reactions. With α-naphthol and concentrated sulphuric acid, it gives no carbohydrate reactions. It contains neither phosphorus (nucleic acid) nor conjugated sulphuric acid (chondroitin-sulphuric acid). In many particulars it agrees with the ovomucoid of eggs.

The soluble proteïd in urine is chiefly serum-albumin; but some is precipitable by acetic acid; and this part consists of a nucleo-proteïd. Precipitated with the proteïd, chondroitin-sulphuric acid is constantly present; this is considered to originate in the kidneys where its presence has been previously shown. The relative amounts of albumin and this acid are variable; thus there is no compound between them. In some cases, taurocholic acid is present in small quantities. W. D. H.

Excretion of Creatinine during Regular Work on a Mixed Diet. By EDWIN ACKERMANN (*Compt. rend. Soc Biol.*, 1894, 659—660).—The experiments made on a man on a mixed diet, and doing regular work, show that, in the mean, the daily output of creatinine is 1·254 gram or 0·017 gram per kilo. of body weight. The amount is lessened by rest. W. D. H.

Resistance of Invertin to Heat. By ROUSSY (*Compt. rend. Soc. Biol.*, 1895, 400—402).—The fever-producing property of invertin is not destroyed by temperatures between 100° and 150°, although it is lessened. The diastatic property of the same substance also is simply attenuated, and not completely destroyed by the same temperatures.
W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Mannitol Fermentation in Sicilian Wines. By G. BASILE (*Staz. Sper. Agrar.*, 1894, **26**, 451—497).—Sicilian wines are subject to an abnormal fermentation, which, in some years, causes very great loss, the chief product of this fermentation being mannitol produced from the glucose; it is generally the red wines which are attacked rather than the white wines, and it is chiefly in hot, dry seasons that this fermentation prevails. The bacterium ferment which produces mannitol, shows the Brownian motions when anaërobic, but is inert when aërobic; and although it may coexist with the alcoholic ferment, it does not predominate until the alcoholic ferment loses its activity. The action of the mannitol ferment may be hindered by racking off the wine when the glucose has been entirely consumed by the alcoholic ferment; or the wine may be pasteurised, and resown with the alcoholic ferment. N. H. J. M.

Action of Metallic Salts on the Lactic Fermentation. By Allyre Chassevant (*Compt. rend. Soc. Biol.*, 1895, 140—142; compare Abstr., 1894, ii, 63).—Salts of magnesium, sodium, lead, gold, and copper, when added to milk in small quantities, produce an acceleration of the lactic fermentation, especially at the commencement. With gold and copper this, in time, is converted into a hindering action. Mixtures of the salts produce a similar action.

W. D. H.

Chemistry of the Barley Plant. By Charles F. Cross, Edward J. Bevan, and Claud Smith (*Ber.*, 1895, **28**, 2604—2609).—The plants were grown during 1894–95 on two of the plots at the Royal Agricultural Society's experimental station at Woburn, one plot being regularly manured, the other left entirely without manure. Samples of the plants were gathered at various periods and analysed, the dried residue, permanent fibre, and the furfuraldehyde obtained from both the dried residue and the permanent fibre being estimated. The results show that the difference in the treatment of the two soils has only a slight influence on the composition of the plant. The atmospheric conditions affect the results very materially, especially the amount of permanent fibre. In the comparatively wet season of 1894 this increased in quantity throughout the whole period, whilst in 1895, the sunny spring of which was followed by wet weather, the amount of permanent fibre became less after the middle of July, and again diminished towards the end of August. The furfuroïds appear to be accumulated as the growth of the plant proceeds, chiefly in the stable or cellulose-like form; at the same time, as shown by the diminution which occurred during the last period of 1895, they are able, when required, to contribute to the necessities of the plant during ripening. A. H.

Tannin Colouring Matters of Red Grapes. By L. Sostegni (*Staz. Sper. Agrar.*, 1894, **27**, 400—413).—The red colouring matter obtained by concentrating wine on a water bath, adding hydrochloric acid, and allowing the mixture to remain overnight, was separated into two portions—one soluble in alcohol, the other insoluble. The former contained $C = 56.62$, $H = 5.00$ per cent., the latter $C = 57.62$, $H = 4.70$ per cent. The reactions of the two portions, which are fully described, indicate the presence in both of catechol and phloroglucinol. The soluble substance seems to contain some other aromatic compound.

More colouring matter was obtained from the residue left on distilling the alcoholic extract of the marc of grapes; after precipitation by water, the substance was washed with hot water, treated with ether, redissolved in alcohol and again precipitated. The reactions much resembled those of the other two products. When heated with sulphuric acid (15 per cent.) at 130° for 12 hours, a compound containing rather more hydrogen than those mentioned above was obtained ($C = 55·77$ and $55·88$; $H = 6·30$ and $6·18$ per cent.). The results generally point to the presence of catechol and resorcinol, possibly also of quinol. N. H. J. M.

Analytical Chemistry.

Arrangement for Washing Precipitates with Boiling Water. By FRANK F. JEWETT (*J. Amer. Chem. Soc.*, 1895, **17**, 517—518).—The water is boiled in a wash-bottle fitted with a trebly perforated indiarubber cork, the steam escaping through an open clip. When a precipitate has to be washed, the clip is closed, and the pressure of the steam at once drives the water through a tube bent at right angles, connected by a few inches of rubber tubing to a jet, which is wound about with a strip of non-conducting material, and may, therefore, be easily handled. The bottle is also connected with an inverted flask fitted with a tube to allow escape of air. If the pressure should become too great, the steam simply forces the boiling water into the inverted flask. On reopening the clip, the water immediately returns to the lower flask. L. DE K.

Estimation of Perchlorate. By D. ALBERT KREIDER (*Zeit. anorg. Chem.*, 1895, **10**, 277—288, and *Amer. J. Sci.*, 1895, [3], **50**, 287—297).—Potassium perchlorate, when boiled with potassium iodide and phosphoric acid, is not reduced until the temperature reaches 215—220°, at which temperature metaphosphoric acid is formed; if, however, metaphosphoric acid is employed, reduction takes place at 200°, and the author has attempted to employ this reaction for the estimation of perchlorate. The best results are obtained by gradually adding the potassium iodide to the mixture heated at about 300° in a current of carbonic anhydride, but the error amounts to from 2 to 5 per cent. A number of experiments are described in which the perchlorate is melted with potassium iodide and an indifferent compound, and the metaphosphoric acid allowed to act on the mixture, but in no case could accurate results be obtained.

When potassium perchlorate is fused with aluminium sodium chloride, $Al_2Cl_6,2NaCl$, chlorine is liberated, which is estimated by absorption in potassium iodide; the reaction must take place in an atmosphere of carbonic anhydride. The results obtained are, however, only accurate to from 1 to 5 per cent.

An accurate estimation of perchlorate is effected by estimating the oxygen evolved when the salt is heated at 400°; this is effected by treating the gas with concentrated hydriodic acid in the presence of a slight excess of nitric oxide, the liberated iodine being titrated with a decinormal solution of arsenious acid. A full description of the apparatus employed is contained in the original paper; great care must be taken to exclude air, and this is effected by means of carbonic anhydride. In order to insure a steady evolution of oxygen from the perchlorate, the latter is covered with a layer of sodium potassium carbonate, the gas being collected in a suitable flask, and then gradually introduced into a flask containing a known quantity of concentrated hydriodic acid containing nitric oxide; meanwhile great care must be taken to shake the mixture without intermission, as otherwise higher oxides of nitrogen will be formed. A constant error of +0·0003 gram of potassium perchlorate must be allowed for, but otherwise the results are accurate. If other oxidising compounds besides perchlorate are present, they are reduced by a reagent which is indifferent to perchlorate, and the filtered solution then evaporated to dryness, and the residue treated as above. The method is also applicable to the estimation of oxygen in air, and in all cases where oxygen is evolved. E. C. R.

Qualitative Analysis of Mixtures of Sulphites, Carbonates, and Sulphates. By LEOPOLDO GIACOMELLI (*L'Orosi*, 1895, **18**, 155).—The saline mixture is placed in a small flask furnished with a tap-funnel and delivery tube, and the sulphurous and carbonic anhydrides, expelled by the gradual addition of, and finally boiling with, dilute hydrochloric acid, are passed through a solution of potassium chromate containing potash free from sulphates and carbonates. If, at the end of the operation, the acid liquid is turbid with sulphur, the mixture must have contained a thiosulphate, whilst, if sulphates are present, these must have been present as such in the original solution. The presence of sulphates in the chromate solution, after warming and acidifying with dilute hydrochloric acid, points, on the other hand, to that of sulphites in the original substance, provided no thiosulphate was present, whilst an effervescence on adding the acid to the chromate solution can only be due to the decomposition of alkali carbonate. JN. W.

Reduction of Selenious and Selenic acids by Hydriodic acid. By FRANK A. GOOCH and W. G. REYNOLDS (*Zeit. anorg. Chem.*, 1895, **10**, 248—252; and *Amer. J. Sci.*, 1895, [3], **50**, 249—252).—Muthmann and Schäfer's method (Abstr., 1893, ii, 318) of estimating selenious acid by reducing it with hydriodic acid and titrating the liberated iodine with thiosulphate is not accurate except under special conditions, but accurate results can be obtained if the iodine is removed from the sphere of action as it is liberated. The mixture of selenious acid, potassium iodide, and hydrochloric acid is distilled, and the iodine collected in a Will-Varentrapp absorption apparatus; a small quantity of iodine, however, always remains in the distillation flask, and this must also be titrated with thiosulphate. Not more than 0·2 gram of selenium dioxide is used for each estimation, and 3 grams of potassium iodide dissolved in 100 c.c. of water; a large excess of hydrochloric acid is without influence on the reaction. Selenic acid is reduced by potassium iodide and hydrochloric acid much more slowly than selenious acid, and the reaction takes place quantitatively only in the presence of a large excess of hydrochloric acid. By employing the distillation method, accurate results are obtained.

E. C. R.

Reduction of Selenic acid by Hydrochloric acid. By FRANK A. GOOCH and P. S. EVANS, jun. (*Zeit. anorg. Chem.*, 1895, **10**, 253—255, and *Amer. J. Sci.*, 1895, [3], **50**, 400—402).—Selenic acid is completely reduced to selenious acid by heating with hydrochloric acid under certain conditions; chlorine is liberated, and can be estimated by means of potassium iodide and thiosulphate. The concentration of the hydrochloric acid is very important; with a solution containing less than 10 per cent. by volume of hydrochloric acid of sp. gr. = 1·2, no action takes place after five minutes' heating. Accurate results are obtained by employing a solution containing one-third of its volume of hydrochloric acid of sp. gr. 1·2, and continuing the distillation until one-third of the total volume in the distillation flask has passed over. Not more than 0·2 gram of selenic acid must be used for each determination. If the strength of the hydrochloric acid is allowed to reach 50 per cent., selenium comes over in the distillate.

E. C. R.

Reduction of Selenic acid by Potassium Bromide in Acid Solution. By FRANK A. GOOCH and W. S. SCOVILLE (*Zeit. anorg. Chem.*, 1895, **10**, 256—258, and *Amer. J. Sci.*, 1895, [3], **50**, 402—404).—Selenic acid is reduced to selenious acid by distillation with potassium bromide and sulphuric acid, the completeness of the action depending on the amount of potassium bromide employed, the strength of the sulphuric acid, and the concentration of the solution during the distillation. When the distillation is continued too long, selenium is liberated, and if an excess of potassium bromide is used, it is difficult to remove the liberated bromine from the distillation flask before the reduction to selenium takes place. The best results are obtained by employing 0·25 gram of selenic acid, 20 c.c. of dilute sulphuric acid (1 : 1), 1 gram of potassium bromide, and a total volume of 60 c.c.; the distillation is carried on until the reduction to selenium commences, which is usually the case when the solution in the distillation flask measures about 35 c.c. The bromine in the distillate is estimated in the usual manner. E. C. R.

Estimation of Nitrogen in Fertilisers containing Nitrates. By H. C. SHERMAN (*J. Amer. Chem. Soc.*, 1895, **17**, 567—576).—After studying the various methods for the estimation of nitrogen in manures containing nitrates, the author arrives at the following conclusions. The official (American) methods are perfectly trustworthy if the directions are followed closely and the digestion with acid is continued for a short time after the mixture has become practically colourless. In analysing samples containing a considerable amount of chlorides, it is, however, advisable to use zinc-dust and to cool the acid mixture before adding it to the sample. It is best to digest for some time at the ordinary temperature before adding the zinc. If the amount of nitric nitrogen is very large, the boiling must be continued a long time, or else a little permanganate must be added to complete the action. L. DE K.

Estimation of Small Quantities of Phosphoric acid by the Citrate Method. By E. G. RUNYAN and HARVEY W. WILEY (*J. Amer. Chem. Soc.*, 1895, **17**, 513—514).—When the amount of phosphoric acid is below 10 per cent., the very convenient and accurate citrate process fails to give results corresponding with those obtained by the molybdate method.

The authors now advise adding a known amount of phosphoric acid, for instance, a solution of calcium phosphate of known strength, in order to bring the strength of the sample up to between 15 and 30 per cent. The results, after allowing, of course, for the added phosphoric acid, will then be quite trustworthy. L. DE K.

Some Conditions affecting the accuracy of the Estimation of Potash as Potassium Platinochloride. By A. L. WINTON (*J. Amer. Chem. Soc.*, 1895, **17**, 453—466).—The author has investigated the conditions under which potassium platinochloride is obtained, and has tabulated the results.

The most interesting result, from an analytical point of view, is that the precipitate obtained by adding platinic chloride to a concentrated solution of a potassium salt consists chiefly of radiating crystals, a characteristic form having six arms, formed by the intersection at right angles of three bars. Numerous globular cavities in the crystals show that, during their rapid formation, mother liquor is inclosed; the compound is therefore difficult to free from water, retaining some even at 160°. On the other hand, the compound formed by mixing dilute solutions of the two metals, and then evaporating, crystallises in octahedrons, generally attached to one another, forming crystalline plates; these crystals are comparatively free from cavities, and become very nearly anhydrous after drying for three hours at 100°. L. DE K.

Estimation of Lime in Soil. By G. BASILE and E. DE CELLIS (*Staz. Sper. Agrar.*, 1894, **27**, 115—156).—In determining the amount of lime in soil, the magnesium carbonate should also be estimated and the physical condition of the carbonates examined; the nature of the predominating rocks of the surrounding country may have to be taken into account in forming an opinion as to the availability of the lime. Calcimetry should be employed in conjunction with direct estimation of lime and of magnesia if present. The error in the calcimetric method increases with soils rich in lime.

Carbonic anhydride is best determined by weighing, employing Schrötter's or a similar apparatus. For calcimetry, Scheibler's apparatus is the best; Bernard's method is not recommended, but that of Houdaille and Sémichon deserves attention. N. H. J. M.

Volumetric Estimation of Zinc, and a New Indicator for Ferrocyanides. By GEORGE C. STONE (*J. Amer. Chem. Soc.*, 1895, **17**, 473—477).—The thoroughly oxidised solution of the ore is washed into a 500 c.c. flask, and barium carbonate, suspended in water, is added until the precipitate of iron and aluminium hydroxides rapidly settle. After making up to the mark, the liquid is filtered, and aliquot portions are taken for titration. The author prefers titrating the manganese only, by means of the well-known permanganate method; the joint amount of zinc and manganese is titrated by means of potassium ferrocyanide.

It was found necessary to obtain a suitable indicator, as both copper sulphate and uranium acetate act on the manganous ferrocyanide; ferric chloride was also quite unsuitable. A very weak solution of cobalt nitrate is free from this objection; it must be applied as follows: A drop of it is placed on a white porcelain plate and a drop of the solution under treatment is added so that the drops touch but do not mix. The slightest excess of ferrocyanide is indicated by a faint greenish zone. L. DE K.

Volumetric Estimation of Copper. By MATTEO SPICA (*Staz. Sper. Agrar.*, 1894, **26**, 593—600).—The copper solution is titrated with a solution of potassium ferrocyanide (containing $K_4FeCy_6 + 3aq = 0{\cdot}0845691$ per cent.), paper prepared with ferric chloride being employed as indicator. The method gave results agreeing well with those obtained by the electrolytic process, whilst Bornträger's method (Abstr., 1894, ii, 120) was found to be unsatisfactory.

The presence of nickel does not greatly affect the result if the quantity is small; but any error from this source may be avoided by first precipitating the copper as sulphide, dissolving the latter in a little nitric acid, treating with ammonia and titrating. This process has the further advantage of rendering it unnecessary to precipitate the iron with ammonia. A table of results obtained by the new method is given. N. H. J. M.

Qualitative Separation of the Metals of the Iron Group. By C. L. HARE (*J. Amer. Chem. Soc.*, 1895, **17**, 537—539).—The solution is mixed with ammonium chloride, and precipitated with excess of ammonia; after warming and filtering, the precipitate is boiled with aqueous soda, in which the alumina dissolves, and may be identified by acidifying and reprecipitating with ammonia. The insoluble residue is again boiled with soda, adding a few c.c. of hydrogen peroxide; a yellow solution indicates chromium, this is acidified with acetic acid, and the presence of chromium confirmed by means of lead acetate. The insoluble residue is finally tested for iron by the ferrocyanide test.

The ammoniacal solution is mixed with ammonium sulphide (free from polysulphide), warmed, and filtered, and the precipitate formed is treated with cold, dilute, hydrochloric acid to dissolve manganese and zinc, which are separated as usual; the insoluble residue is then dissolved in nitro-hydrochloric acid, and after expelling the excess of the latter by heating, tartaric acid is added, and then a large excess of aqueous soda. From this solution the cobalt is precipitated by a current of hydrogen sulphide, and the precipitate may be further recognised by the borax bead test. On acidifying the alkaline solution, nickel sulphide separates, and may then also be tested with borax.

L. DE K.

Qualitative Separation of Chromium from Iron. By LEOPOLDO GIACOMELLI (*L'Orosi*, 1895, **18**, 48—49).—The methods usually employed in the separation of chromium from iron in systematic qualitative analysis, yield unsatisfactory results when the relative amount of chromium is small, as the salts of the latter are liable to be carried down with the ferric hydroxide, or retained by the ferric oxide. The chromium is best separated by oxidising the ammonia precipitate containing only the mixed ferric, chromium, and aluminium hydroxides with a few drops of nitric acid, and a crystal or two of potassium chlorate; the precipitate should be fairly well dried in a capsule before the addition of the oxidising agent, and the heating with the latter continued until the evolution of chlorinous fumes ceases. The chromium being thus oxidised to chromic acid, the iron and alumina can be precipitated as hydroxides with ammonia from the aqueous solution, and separated by means of caustic soda in the usual way, whilst the chromic acid can be recognised in the filtrate by means of lead acetate after acidification with acetic acid.

JN. W.

Estimation of Benzene in Illuminating Gas. By WILLIAM A. NOYES and W. N. BLINKS (*J. Amer. Chem. Soc.*, 1894, **16**, 697—698).—One hundred c.c. of gas is measured in a Bunte burette, best with a side tube or bottle attached below, so that the gas is brought to atmospheric pressure. The water is then completely removed from the cup above, and the water in the burette is driven down to the lower stopcock as usual, for the introduction of reagents. Two or three c.c. of absolute alcohol is poured into the cup, and allowed to enter the burette 1 c.c. at a time, care being taken that the walls of the burette are thoroughly moistened with it. After withdrawing the alcohol in the usual manner, 2 or 3 c.c. of water is admitted above and withdrawn below, and more water is then admitted until the gas is brought to the original pressure. The difference between the two readings represents the benzene vapour which has been absorbed by the alcohol.

L. DE K.

Densimetric Estimation of *d*-Glucose in Urine. By THEODOR LOHNSTEIN (*Pflüger's Archiv*, 1895, **62**, 82—110).—The multiplicator in Roberts' method of sugar estimation is not a constant, but varies with the specific gravity of urine free from sugar, with the percentage of sugar, and with the temperature. The removal of the yeast also makes a difference.

If p = amount of sugar,
t = temperature at which the sp. gr. is taken,
S' = sp. gr. of urine free from sugar,
p = percentage volume.
f = Robert's factor,

and the yeast remain in suspension.

$$f = 234 - \tfrac{3}{7}(p - 3) + \tfrac{3}{4}(t - 20) + 487\ S' - 1{\cdot}02)$$

From this equation it follows that if p varies from 0 to 10, t from 15° to 25°, and s from 1·01 to 1·03, f will vary from 222·3 to 244. There is thus a possible error of 5 per cent., although for most average cases the number 234 is pretty near.

If S_1 = sp. gr. of the urine + yeast before fermentation,
S_2 = „ „ „ after „
t_1 and t_2 = the respective temperatures at which S_1 and S_2 are observed.
v_1 = volume of original urine.
v_2 = „ urine after the addition of yeast,

then $p = [S_1 - S_2 + 0{\cdot}002\,(t_1 - t_2)] \times 234$ if t_2 lies between 15° and 20°,

and $= [S_1 - S_2 + 0{\cdot}003\,(t_1 - t_2)] \times 234$ if t_2 lies between 20° and 25°.

also $S_1 = S_2 + \dfrac{S_1 - S_2}{6}.$

A better value for p is the following.

$$p = \frac{v_2}{v_1}\left(S_1 - S_2 + \left\{\begin{matrix}0{\cdot}0002\,(t_1 - t_2)\\ 0{\cdot}0003\,(t_1 - t_2)\end{matrix}\right\} f.\right.$$

S_1 and S_2 should be known to three decimal places.

By such equations, the percentage of sugar can be estimated to 0·1 per cent. W. D. H.

The Polarising Microscope and Zeiss' Refractometer applied to Butter Analysis. By CARLO BESANA (*Staz. Sper. Agrar.*, 1894, **26**, 601—604).—By means of the polarising microscope, 5 per cent. of margarine in butter can be detected; but butter which has been melted, and old butter, give rise to an appearance similar to that caused by margarine, so that the method can only be utilised for establishing the purity of butter.

As regards Zeiss' refractometer, determinations should be made at a definite temperature (35° is convenient), as rise of temperature lowers the refractive indices; the temperature should be maintained constant during the experiment by means of a current of water. One hundred and eight samples of butter gave at this temperature the average result = 46, the maximum and minimum limits being respectively 47 and 44·8. Commercial margarine showed from 50 to 51; cocoa fat, 38·2; olive oil, 57; and sesame oil, 62. No effect on the result seemed to be caused by the butter being rancid. Considering the comparatively slight differences in the refractive indices of butter and margarine, a considerable admixture of the latter has but little effect on the result. Samples of butter which give results lower than 46 may be considered genuine; in others, the volatile acids should be determined. N. H. J. M.

Estimation of Volatile and Insoluble acids in Butter. By W. H. BEAL (*J. Amer. Chem. Soc.*, 1894, **16**, 673—676).—2·5 grams of the clear butter fat is introduced into a long, narrow, 200 c.c. Erlenmeyer flask. Saponification is accomplished by adding 2 c.c. of aqueous potash (1—2), and 5 c.c. of 95 per cent. alcohol and boiling, using a reflux condenser; five minutes is amply sufficient. The spirit must then be removed by means of a filter pump (Nilson, Abstr., 1889, 801). The soap is dissolved in 30 c.c. of hot water, and decomposed with 20 c.c. of 20 per cent. phosphoric acid; the volatile acids are then driven off in a current of steam generated by boiling about 700 c.c. of water in a litre flask, but in order to prevent accumulation of liquid in the Erlenmeyer flask, the contents of the latter should be kept boiling by means of a spirit lamp. The cooling apparatus consists of a deep trough, through which pass one or more glass spirals, fitted by india-rubber corks, and the distillate is collected in a wide-mouth Erlenmeyer flask, marked at 500 c.c., and carrying a funnel with a small filter. The distillate is finally titrated, as usual, with N/10 soda and phenolphthaleïn. When the distillate amounts to 500 c.c., it may be taken for granted that all the volatile acids have passed over, but by way of extra precaution another 50 c.c. may be distilled off and titrated separately. To collect the insoluble acids, the condenser and connections are rinsed back with boiling water into the distilling flask; after cooling, the acid liquid is filtered through the same filter, and the washing and cooling is repeated until all the phosphoric acid is removed. The filter is then extracted with boiling alcohol, which is allowed to run into the distilling flask. After expelling the alcohol and drying the fatty acids at 100°, they are weighed. L. DE K.

Untrustworthiness of Creamometers for the Estimation of Fat in Pasteurised Milk. By PAUL CAZENEUVE and E. HADDON (*Bull. Soc. Chim.*, 1895, [3], **13**, 500—502).—It is generally admitted that the cream in boiled milk cannot be accurately estimated by means of the creamometer, but no exact experiments seem to have been made on this point, nor any with milk sterilised by the well-known methods.

The authors find that milk sterilised by Pasteur's method at 70—75°, or 80°, yields, at most, half its cream, even after 27 hours, but that, when sterilised at 100° or 115° by Cazeneuve's method (this vol., ii, 120), out of contact with the air, it yields practically the whole of its cream in the usual way.

The boiling of milk in the open air probably causes the oxidation and partial coagulation of the caseïn, and so leads to the retention of the fat. JN. W.

Estimation of Urea in Blood and Tissues. By MAURICE KAUFMANN (*Compt. rend. Soc. Biol.*, 1895, 145—147).—Gréhant's method of estimating urea consists in extracting the blood or tissues with alcohol, evaporating the alcoholic extract, and decomposing the urea in the residue with Millon's reagent ("mercure nitreux") into equal volumes of carbonic anhydride and nitrogen in the vacuum of a mercurial pump. Other extractives are not thus broken up. The results are described as very satisfactory. W. D. H.

Estimation of Urea in Animal Organs and Liquids. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv*, 1895, **62**, 1—57).—After a review of previous work on the subject of the estimation of urea, experiments are recorded which led to the following conclusions. The amido-acids, glycocine, alanine, leucine, sarcosine, taurine, tyrosine, metamidobenzoic acid, and aspartic acid give off all their nitrogen when treated by the Kjeldahl process. They are not precipitated by a mixture of phosphotungstic and hydrochloric acids; when heated with phosphoric anhydride at 150°, they do not give off nitrogen; at 230°, however, they give off all their nitrogen, except taurine, for which a temperature of 240° is necessary; and when heated with an alkaline solution of barium chloride at 150°, only traces of carbonic anhydride, coming within the limits of experimental error, are evolved.

Urea is completely decomposed into carbonic acid and ammonia by four and a half hours' heating at 150°. By heating with phosphoric anhydride at 150°, it yields all its nitrogen; by heating at 150° with alkaline solution of barium chloride in a sealed tube, the full amount of carbonic anhydride is obtained.

The substances of the uric acid group (uric acid, allantoïn, alloxantine, caffeïne, xanthine, guanine) are insoluble in absolute alcohol, and are, with the exception of allantoïn and alloxantine, completely precipitated from their solutions by the mixture of phosphotungstic and hydrochloric acids.

Creatine is almost insoluble in absolute alcohol, and is not precipitated by the acid mixture (see below). On heating a solution for ten hours with dilute acetic acid, it is converted into creatinine, and is then precipitable by the acid mixture to the extent of 74 per cent. By heating with phosphoric anhydride at 150°, it yields 1 mol. of ammonia, splitting up into methylhydantoïn and ammonia. By heating with alkaline barium chloride solution, it splits up into sarcosine and urea, so that, therefore, on analysis, 1 mol. of carbonic anhydride and 2 mols. of ammonia are obtained. By heating with phosphoric anhydride at 150°, creatine yields 1 mol. of ammonia, and with alkaline barium chloride solution at 150°, 1 mol. of carbonic anhydride, whilst urea under the same circumstances yields 2 mols. of ammonia and 1 mol. of carbonic anhydride respectively. In estimating urea by this method, it is necessary that creatine should be absent.

Creatinine is completely precipitable from an aqueous solution by a mixture of phosphotungstic and hydrochloric acid. By heating with alkaline barium chloride solution at 150°, it behaves like creatine, but with phosphoric anhydride there is only an incomplete decomposition.

The method devised from such experiments for the estimation of urea in blood and other animal fluids is as follows: the proteïd and extractives are first precipitated by the acid mixture. In the case of organs, these are finely minced, and extracted with alcohol; the extract, after acidification with acetic acid, is evaporated to dryness at 50°, and the residue taken up with alcohol and again evaporated to dryness. The residue is then taken up with hot water, and the acid mixture added. In either case, the precipitate produced filtered off, the filtrate made alkaline with powdered lime, and in it the total nitrogen, the nitrogen evolved by heating at 150° with phosphoric anhydride, and the carbonic anhydride obtained by heating with alkaline barium chloride solution at 150° are estimated, and the results compared; there should be 1 mol. of carbonic anhydride to 2 mols. of ammonia.

The acid mixture has the following composition: 100 c.c. of hydrochloric acid (sp. gr. 1·124), or an equivalent quantity of sulphuric acid, is placed in a litre flask, which is then filled up with phosphotungstic acid solution. W. D. H.

Detection of Creatinine in Urine. By WILLIAM OECHSNER DE CONINCK (*Compt. rend. Soc. Biol.*, 1895, 111—112).—The coloration produced in pathological urine by the addition of sodium nitroprusside and sodium hydroxide may be due not only to creatinine but also to acetone. W. D. H.

Morphine Reactions. By GUSTAVE BRUYLANTS (*Bull. Soc. Chim.*, 1895, [3], **13**, 497—500).—In addition to the well-known violet coloration with sulphomolybdic acid, a green coloration may be produced by varying the conditions of reaction. In either case, the alkaloïd is dissolved in concentrated sulphuric acid; to obtain the violet coloration, a drop of the cold solution is mixed on a white tile with a drop of the reagent (0·01 gram of ammonium molybdate per c.c.), whilst, to obtain the green coloration, the morphine solution is previously heated for a few minutes on a water bath. Both colorations are changed to orange by the addition of a crystal of nitre.

Similar colour reactions are given by the other opium alkaloïds.

The iodic acid test may be modified by adding the solid acid to a solution of morphine in concentrated sulphuric acid at 100°; a lilac coloration is formed, changing to red and slowly disappearing; or, with larger quantities of iodic acid, a red coloration is produced at once. JN. W.

Estimation of Albumin in Cow's Milk. By L. L. VAN SLYKE (*J. Amer. Chem. Soc.*, 1894, **16**, 712—715).—*Estimation of Caseïn.*—Ten grams of milk is diluted with 90 c.c. of water at 40—42°, mixed with 1·5 c.c. of 10 per cent. acetic acid, and the mixture stirred with a glass rod and allowed to remain for about five minutes. The coagulated caseïn having been first washed by decantation, and then a few times on a filter, the filter and contents are treated for nitrogen by the Kjeldahl process. The author uses the factor 6·25 for the calculation of the nitrogen to caseïn.

Estimation of Albumin.—The filtrate from the caseïn is placed in a boiling water bath for 10 or 15 minutes. The precipitate, after washing, is then also treated by Kjeldahl's method. The same factor is used.

Remaining Nitrogenous Compounds.—The author prefers to take these by difference, by subtracting from the amount of total nitrogen compounds (determined by Kjeldahl's method) the sum of the caseïn and albumin. L. DE K.

General and Physical Chemistry.

Refractometric Observations. By Jan F. Eijkman (*Rec. Trav. Chim.*, 1895, **14**, 185—202; compare Abstr., 1894, ii, 173).—The author has determined the refractive indices for the hydrogen lines α and β and A of a large number of organic substances, each being examined at two temperatures differing by 30° to 125°.

At high temperatures, Gladstone and Dale's molecular refraction formula gives too low values, whilst Lorenz's expression gives too high values; it should therefore be possible to obtain a molecular refraction formula which should give concordant values at all temperatures. By calculating from the experimental numbers now obtained, the author finds that the results are best represented by the expression $(n^2 - 1)M/(n + 0{\cdot}4)$, in which n is the refractive index, and M the molecular volume, and he therefore proposes to take this expression as the molecular refraction. If the new formula is employed, the agreement between the observed and calculated molecular refractions becomes very close, and the dispersion equivalent for the increment of an homologous series, CH_2, acquires a constant value.

W. J. P.

Molecular Origin of the Absorption Bands of Salts of Cobalt and Chromium. By Alexandre L. Étard (*Compt. rend.*, 1895, **120**, 1057—1060).—Violet solutions of chromium sulphate and nitrate, and of chrome alum, exhibit a fine absorption band in the red, $\lambda = 678—670$. Addition of a nitrite changes the colour of these solutions to lilac, and an arsenate turns them green, but the above characteristic band remains in the absorption spectrum, and is only shifted a little towards the red, $\lambda = 687—680$. Chromic acid in concentrated solution also shows this band. On the other hand, anhydrous chromyl chloride, potassium chromate and dichromate, and roseochromic sulphate give no distinct band. The blue chromium potassium oxalate gives absorption bands in the red at $\lambda = 700—693$ and $\lambda = 732—729$.

The red solution of cobalt sulphate gives a band, $\lambda = 654—650$, and the red solution of cobalt chloride a band, $\lambda = 667—642$. If these solutions are turned blue by heating and adding a little concentrated hydrochloric acid, two additional bands appear in the red, but the bands of the red solutions still remain visible.

The author concludes that the absorption bands of the chromium and cobalt compounds are not due to the atoms of the metals, but to the internal arrangement of the molecules. As these absorption spectra resemble in character those of the rare earth and of uranium compounds, the hypothesis that each band in the spectrum of a rare earth corresponds with some element, is not necessarily true.

H. C.

Anomalous Rotatory Dispersion of Malic acid. By Raffaele Nasini and G. Gennari (*Gazzetta*, 1895, **25**, i, 417—438).—Employing a Landolt-Lippich polarimeter, fitted with the ray-filters recently described by Landolt (Abstr., 1895, ii, 1), the authors have examined the rotatory dispersion of malic acid dissolved in various solvents, under different conditions of concentration and temperature; the mean wave-lengths, $\mu\mu$, in millionths of a millimetre of the various rays employed, are 665·9, 591·9, 553·0, 448·5, and 448·2. In a 4·6 per cent. aqueous solution at 20°, the specific rotation for all these rays is a lævo one; for red light of $\mu\mu = 665{\cdot}9$, the value $[\alpha] = -1{\cdot}87°$, whilst for $\mu\mu = 448{\cdot}2$ $[\alpha] = -2{\cdot}51°$; as the concentration increases, the temperature remaining the same, the solutions become more and more dextrorotatory, until in a 72·8 per cent. aqueous solution, the values of $[\alpha]$ for the above wave-lengths become $+1{\cdot}80°$ and $+6{\cdot}39°$ respectively. At intermediate concentrations, the solutions become inactive for one or other wave-length of light, although the particular solution for which $[\alpha] = 0$ for light of one wave-length is strongly active towards a different coloured light.

As the temperature of the solution rises, the value of $[\alpha]$ becomes more negative; thus at 7° a 33·24 per cent. aqueous solution has a specific rotation of $[\alpha] = +0{\cdot}44°$ for the ray $\mu\mu = 665{\cdot}9$, and of $+2{\cdot}63°$ for the ray $\mu\mu = 448{\cdot}2$, whilst at 41·5° these rotations become $-5{\cdot}96°$ and $-5{\cdot}84°$ respectively.

The addition of boric acid to the solution acts in the same way as a rise in temperature. Malic acid has nearly the same specific rotation in both methylic and ethylic alcohols, and the variation in rotation with varying concentration is of much the same kind as when water is the solvent; the solutions are, however, much more lævorotatory than aqueous solutions. The same seems to hold for propylic alcohol and acetone, although the lævorotation is not so high as when the solvent is methylic or ethylic alcohol.

A number of solutions of sodium malate were examined, showing that the specific rotations for light of various wave-lengths change in much the same way as with the acid itself. The dispersion coefficients of aqueous solutions of malic acid change very irregularly with the concentration, whilst those for sodium malate vary much less with the concentration.

After a full discussion of these anomalies, the authors are unable to furnish any explanation of them; they can hardly be due to changes in the degree of ionisation, malic acid being so slightly dissociated in aqueous solution. There is also no evidence indicating the existence of hydrates or polymerides in solution, as cryoscopic determinations show that, in concentrated aqueous solutions malic acid has the normal molecular weight. W. J. P.

New Examples of the Superposing of the Optical Effects of Two Asymmetric Carbon Atoms. By PHILIPPE A. GUYE and C. GOUDET (*Compt. rend.*, 1895, **121**, 827—829).—The amylic amylacetate of the formula $\overset{*}{C}HMeEt{\cdot}CH_2{\cdot}CH_2{\cdot}COO{\cdot}CH_2{\cdot}\overset{*}{C}HMeEt$ contains two asymmetric carbon atoms, each of which should behave towards polarised light as though the rest of the molecule were inactive (Abstr., 1895, ii, 149). The authors have prepared compounds of the above formula from (*a*) a mixture of dextrorotatory amylacetic acid and racemic amylic alcohol, (*b*) a mixture of racemic amylacetic acid and lævorotatory amylic alcohol, and (*c*) a mixture of the dextrorotatory acid and the lævorotatory alcohol. The first compound has the rotation $[\alpha]_D = +4\cdot36$, and the second $[\alpha]_D = +1\cdot54$. Theoretically, therefore, that of the third should be $+4\cdot36 + 1\cdot54 = +5\cdot90$, and the number actually found was $[\alpha]_D = +5\cdot64$, in close agreement with the theory.

The amylic amylmalonate, $\underset{*}{\mathit{C}}HMeEt\cdot CH_2\cdot CH(COO\cdot CH_2\cdot \underset{*}{\mathit{C}}HMeEt)_2$, contains three asymmetric carbon atoms. Compounds of this formula were prepared from (*a*) dextrorotatory amylmalonic acid and racemic amylic alcohol, (*b*) racemic amylmalonic acid and lævorotatory amylic alcohol, and (*c*) dextrorotatory amylmalonic acid and lævorotatory amylic alcohol. The first compound has the rotation $[\alpha]_D = +6\cdot10$, and the second $[\alpha]_D = +3\cdot48$. The rotation of the third should therefore be $+9\cdot58$, and the number actually found was $[\alpha]_D = +9\cdot68$, the theory being thus again confirmed. H. C.

Optically Active Derivatives of Succinic acid. By Paul Walden (*Zeit. physikal. Chem.*, 1895, **17**, 245—266).—The product of asymmetry, P, of a substance containing four groups of molecular weights g_1, g_2, g_3, and g_4 attached to one asymmetric carbon atom, is obtained from the equation

$$P = \frac{(g_1 - g_2)(g_1 - g_3)(g_1 - g_4)(g_2 - g_3)(g_2 - g_4)(g_3 - g_4)(l \sin \alpha)^6}{(g_1 + g_2 + g_3 + g_4)^6};$$

omitting the constant term $(l \sin \alpha)^6$, the product of asymmetry is supposed by Guye and his supporters (Abstr., 1893, ii, 561) to be a measure of the rotatory powers of optically active organic substances. The author has prepared a large number of derivatives of malic and succinic acids, and shows that in the several series of compounds thus obtained, the product of asymmetry does not, in most cases, even indicate correctly whether the specific rotation of a substance will increase or decrease when the mass g of one of the four groups is altered by substitution. Thus the specific rotations $[\alpha]_D$, and the molecular rotations $[M]_D$, of many of the substances mentioned in the accompanying table should be negative in sign, judging by the products of asymmetry, whilst others which should be either lævorotatory or inactive are highly dextrorotatory.

An inspection of the table shows that the ethereal salts of malic acid are dextrorotatory, the specific rotation rising as the mass of the alkyl group increases, until the maximum is attained at about the propylic salt; the amides are more lævorotatory than the salts, and their specific rotation increases with the mass of the substituted amidogen. The alkylic salts of the substituted malic acids are lævorotatory, and have about double the specific rotations of the parent alkylic malates; the derivatives of chlorosuccinic and bromosuccinic acids prepared from lævo-derivatives of malic acid are all highly dextrorotatory, and the specific rotations of the bromo-compounds are higher than those of the corresponding chloro-derivatives. Isomerides, or two compounds which contain groups of approximately the same mass, although of different kind, have not the same rotatory powers. Two substances of the same molecular weight, differ-

Substance.	$[\alpha]_D$.	$[M]_D$.	*d*.	*n*.	R.	
					Observ.	Calc.
Dimethylic malate......	− 6·85°	−11·10°	1·2317	1·4425	34·78	34·98
Diethylic „	−10·18	−19·35	1·1294	1·4362	44·00	44·18
Dipropylic „	−11·62	−25·32	1·0745	1·4380	53·26	53·40
Diisopropylic malate....	−10·41	−22·69	1·076	—	—	—
Diisobutyric „	−11·14	−27·39	1·0418	1·4392	62·14	62·60
Diamylic „	− 9·92	−27·19	1·079	1·4438	71·48	71·80
Dicaprylic „	− 6·92	−24·77	0·9761	1·4500	98·57	99·42
Dimethylic acetylmalate	−22·92	−46·76	1·1975	1·4318	44·17	44·52
„ propionylmalate	−22·94	—	—	—	—	—
„ butyroylmalate	−22·44	−52·07	1·1317	1·4342	53·41	53·73
„ isobutyroylmalate	−22·36	−51·86	1·1255	1·4310	53·35	53·73
„ isovaleroylmalate	−22·39	−55·07	1·1034	1·4350	58·18	58·34
„ chloracetylmalate	−23·30	−55·56	1·3862	1·4530	49·35	49·48
„ bromacetylmalate	−22·40	−63·38	1·5072	1·4680	52·20	52·41
Diethylic acetylmalate..	−22·52	−52·25	1·1168	1·4295	53·61	53·73
„ propionylmalate	−22·20	−54·62	1·0958	1·4308	58·09	58·33
„ butyroylmalate	−22·22	−57·78	1·0736	1·4315	62·75	62·94
„ isobutyroylmalate	−21·99	−57·17	1·0688	1·4285	62·65	62·94
„ isovaleroylmalate	−22·07	−60·46	1·0605	1·4338	67·26	67·55
„ bromacetylmalate	−22·48	−69·92	1·3936	1·4610	61·24	61·61
„ bromopropionylmalate	−22·48	−73·05	1·3325	1·4561	66·31	66·22
„ bromobutyroylmalate	−24·76	−83·93	1·3059	1·4568	70·68	70·82
„ bromisobutyroylmalate	−22·57	−76·50	1·2850	1·4520	71·17	70·82
„ ethoxysuccinate	− 1·44	− 3·13	1·1045	1·4320	54·10	53·55
Dipropylic acetylmalate.	−22·85	−59·40	1·0724	1·4315	62·82	62·94
„ chloracetylmalate	−23·52	−69·26	1·1566	1·4465	67·96	67·88
„ butyroylmalate	−22·40	−64·50	1·0417	1·4348	72·11	72·15
„ isovaleroylmalate	−21·68	−65·47	1·0263	1·4352	76·81	76·75
„ bromacetylmalate	−22·24	−75·41	1·3150	1·4608	70·71	70·82
Diisobutyric acetylmalate	−21·88	−63·01	1·0362	1·4330	72·32	72·15
„ butyroylmalate	−21·68	−68·52	1·0146	1·4352	81·30	81·35
„ isovaleroylmalate	−19·91	−65·70	1·0045	1·4353	85·78	85·96
„ bromacetylmalate	−20·38	−74·80	1·2022	1·4520	82·36	80·03

Substance.	$[\alpha]_D$.	$[M]_D$.	*d.*	*n.*	R.	
					Observ.	Calc.
Chlorosuccinic chloride..	+29·53	+55·93	1·5002	1·4840	36·12	35·73
Dimethylic chlorosuccinate	+41·42	+74·76	1·2555	1·4436	38·16	38·40
Diethylic chlorosuccinate	+27·50	+57·33	1·1493	1·4372	47·55	47·61
Dipropylic „	+25·63	+60·61	1·0925	1·4412	57·19	56·82
Diisobutyric chlorosuccinate	+21·57	+57·05	1·0524	1·4403	66·28	66·03
Diamylic chlorosuccinate	+21·56	+63·07	1·0319	1·4436	75·24	73·23
Dimethylic bromosuccinate	+51·18	+114·37	1·5050	1·4618	41·32	41·33
Diethylic bromosuccinate	+40·96	+103·63	1·3550	1·4550	50·66	50·54
Dipropylic bromosuccinate	+38·05	+106·9	1·3010	1·4592	59·07	59·74
Diisobutyric bromosuccinate	+23·56	+72·80	1·2394	1·4580	68·03	68·94

ently distributed in the two cases between the four molecular groups, have sometimes nearly the same, and sometimes very different rotatory powers; in some cases, a considerable alteration in the mass of a group causes only a very small change in the rotatory power.

In addition to the specific and molecular rotations of the various substances determined at 20°, the table gives the densities *d*, at 20° referred to water at 0°, and the refractive indices *n*, for the D line at 20°, together with the observed and calculated molecular rotations R, obtained from Gladstone's formula. W. J. P.

Optically Active Derivatives of Phenylacetic acid: Optical Superposition. By PAUL WALDEN (*Zeit. physikal. Chem.*, 1895, **17**, 705—724; compare preceding Abstr.).—Starting with mandelic acid, in which the four groups attached to the asymmetric carbon atom have the masses 77, 45, 17, and 1, the author has prepared and examined the rotatory powers of a number of derivatives in which the masses of the above four groups vary; from the data thus obtained, the author shows that, as in the case of the malic acid derivatives, the product of asymmetry affords no criterion of the rotatory power, and deduces conclusions similar to those stated in the preceding abstract. The carboxyl group in mandelic acid is of practically the same mass as the group $CONH_2$ in mandelamide, so that these two substances should have almost the same rotatory power. Table I, however, shows $[\alpha]_D$ to be very different in the two cases. Similarly, tartaric diamide has a specific rotation in water or saturated boric acid solution of $[\alpha]_D = +108°$ to 109·4°, whilst for tartaric acid $[\alpha]_D = +14·93$.

The very different specific rotations possessed by ethylic mandelate in acetone and carbon bisulphide solutions seem not to be due to a difference in molecular weight, as this substance depresses the boiling point of the two solvents normally.

TABLE I.

Substance.	$[\alpha]_D$.	$[\alpha]_D$.	$[\alpha]_D$.
Mandelic acid	−153·1° in H_2O...	−148·0° in $COMe_2$	
Mandelamide........	− 66·7 „ $COMe_2$	—	
Methylic mandelate ..	−110·2 „ $COMe_2$	−214·1 in CS_2.	
Ethylic „ ..	−123·12 liquid ...	− 88·8 „ $COMe_2$	−180·0° in CS_2.
Isobutyric „ ..	−100·73 „ ...	−145·0 „ CS_2.	
Amylic „ ..	− 96·46 „ ...	—	
Methylic acetylmandelate	−146·37 „ ...	—	
„ propionylmandelate	−135·5 „ ...	—	
Ethylic propionylmandelate	−113·7 „ ...	−110 in $CHCl_3$ ..	−129 in CS_2.
„ valeroylmandelate	− 97·06 „ ...	−117 „ CS_2.	
Acetylmandelic acid ..	−156·4 in $COMe_2$.	—	
Phenylchloracetic acid	+131·8 „ C_6H_6 ..	+131·3 in CS_2....	+107·9 in $CHCl_3$.
„ chloride	+158·3 „ CS_2....	—	
Methylic phenylchloracetate	+107·55 liquid ...	—	
Ethylic phenylchloracetate	+ 25·19 „ ...	+ 26·39 in CS_2...	
Propylic phenylchloracetate	+ 23·94 „ ...	—	
Amylic phenylchloracetate	+ 23·31 „ ...	—	
Phenylbromacetic acid	+ 45·4 in C_6H_6...	—	
Methylic phenylbromacetate	+ 29·82 liquid ...	—	
Ethylic phenylbromacetate	+ 16·56 „ ...	—	
Isobutyric phenylbromacetate	+ 9·77 „ ...	—	
Phenylbromacetic bromide	+ 44·53 „ ...	—	

In order to test the principle of "optical superposition," which states that the several optically active groups in a given molecule act additively and in such a way that the specific rotation of a substance becomes the algebraic sum of the specific rotations of two of its stereoisomerides, the author has examined a number of suitable salts and obtained results which are summarised in Table II. The density *d*, the molecular rotation $[M]_D$, and the specific rotation $[\alpha]_D$, of each series of three salts was determined; the last column contains the specific rotation of the third salt of each series calculated as the sum of the specific rotations of the first and second. The specific rotations of lævo-amylic lævo-lactate is thus the sum of the specific rotations of inactive amylic lævo-lactate and lævo-amylic inactive lactate; the agreement, as will be seen, is very close.

TABLE II.

	d.	$[M]_D$.	$[\alpha]_D$.	
			Observ.	Calc.
i-amylic *l*-lactate	0·9719	− 10·21°	− 6·38°	—
l- „ *i*- „	0·9672	+ 4·22	+ 2·64	—
l- „ *l*- „	0·9667	− 6·29	− 3 93	− 3·74
i-amylic *l*-mandelate	1·0531	−214·14	−96·46	—
l- „ *i*- „	1·0520	+ 6·12	+ 2·76	—
l- „ *l*- „	1·0530	−208·72	−94·02	−93·70
i-amylic *d*-phenylchloracetate	1·0828	+ 56·08	+23·31	—
l- „ *i*- „	1·0832	+ 7·78	+ 3·23	—
l- „ *d*- „	1·0826	+ 64·42	+26·79	+26·54
i-diamylic *l*-malate	1·0790	− 27·19	− 9·92	—
l- „ *i*- „	1·0180	—	+ 3·50	—
l- „ *l*- „	1·0176	− 18·85	− 6·88	− 6·42
i-diamylic *d*-chlorosuccinate	1·0319	+ 67·03	+21·56	—
l- „ *i*- „	1·0314	+ 10·98	+ 3·75	—
l- „ *d*- „	1·0305	+ 73·53	+25·15	+25·31
i-diamylic *d*-tartrate	1·0637	—	+14·10	—
l- „ racemate	1·0640	—	+ 3·37	—
l- „ *d*-tartrate	1·0636	—	+17·73	+17·47

W. J. P.

Optically Active Halogen Compounds. By PAUL WALDEN (*Ber.*, 1895, **28**, 2766—2773).—See this vol., i, 139.

The Birotation of Glucose. By HEINRICH TREY (*Zeit. physikal. Chem.*, 1895, **18**, 193—218).—The birotation phenomena of glucose were investigated in aqueous and other solutions, both the anhydride and the hydrate being employed. In solutions in methylic and ethylic alcohol, birotation occurs as in water, but more slowly, whilst also the final value is higher than in aqueous solution, both initial and final values being higher in ethylic than in methylic alcohol. By the addition of water to the alcoholic solution, the retrogression was accelerated and the final value also reduced to an extent corresponding with the quantity of water added. Chemically indifferent compounds cause a retardation in the methylic alcohol solution of the anhydride, and a slight increase of the end value. In aqueous solutions of both anhydride and hydrate, acids cause an acceleration, the effects in this respect being in the same order as the affinity constants. By the addition of hydrogen chloride, even in small quantities, to the methylic alcohol solution, the rotation was reduced to zero, this being probably due to decomposition. By the solution in water of the amorphous residue left on evaporating an alcoholic solution, the end value of the rotation was at once obtained, and the author considers that his experiments indicate that the explanation of the birotation is to be sought for, not in the hydration of the compound, but in a change from a crystalline to an amorphous variety, or in some such alteration of the molecular configuration. (Compare also Levy, Abstr., 1895, ii, 586.) L. M. J.

Theory of the Decomposition of Racemic Compounds. By CHR. WINTHER (*Ber.*, 1895, **28**, 3000—3023).—The author enunciates a general theory respecting the decomposition of racemic compounds into their optically active constituents either by means of active bases or by crystallisation. The theory only holds good for compounds in the solid state or in saturated or supersaturated solutions. The atoms or groups attached to the asymmetric carbon atom of one molecule are supposed to have certain affinities for the corresponding atoms or groups in a second molecule. These affinities the author terms "secondary," and supposes they are of two kinds. For example, in the case of a compound containing an asymmetric carbon atom to which hydrogen and hydroxyl are attached, the affinity between the H and H, or between OH and OH, is termed "racemic" affinity, and that between H and OH "contrary" affinity. If, under given circumstances, the racemic affinities of a compound are greater than the contrary affinities, it will be found impossible to split up the compound into its active constituents by the above means; in order to bring about such a decomposition, energy, either thermal or chemical, must be supplied to the system. Under a certain set of conditions there will always be an equilibrium between the two secondary affinities. It is shown that the theory agrees with the facts hitherto known regarding the decomposition of racemic compounds, and the paper concludes with an index to the literature of the subject. J. J. S.

Flames and Illuminating Gases. By C. BOHN (*Zeit. physikal. Chem.*, 1895, **18**, 219—239).—The form of Bunsen burner devised by Teclu (Abstr., 1892, 768) was used for the experiments. The appearance of the flame is first described, five parts being recognised—(1) the inner cone surrounded by (2) the mantle, around which lie (3) the outer cone with (4) its border, above which is (5) the cap. The variations in the several parts according to the air supply is recorded, and then the spectroscopic examination. The cap gave a feeble continuous spectrum with no red and but little blue; the border also gave a continuous spectrum with the red feebly developed; that of the outer cone was also continuous, dark and bright lines being absent, and the red being well developed. The mantle, however, gave a band spectrum with well-marked green and indigo or violet bands, and under some circumstances a blue stripe also, and a dark band close to the D lines. The inner cone appeared to give a feeble band spectrum, most probably, however, due to the mantle. The author considers the mantle to be the place of explosive combustion and of the greatest development of energy, although not necessarily the hottest part of the flame. Sulphur, hydrogen, carbon bisulphide (by a wick), and carbonic oxide were also burnt, and for all these flames, the spectra were continuous. The measurements of the band spectra are recorded, the results being compared with those obtained by Swan. The spectroscopic measurements are also recorded in the case of Geissler tubes containing various carbon compounds, and the author concludes that the discontinuous spectra of carboniferous gases are not identical, the differences being greater than those occasioned by alterations of temperature and density. It is hence not possible to define a carbon band spectrum, and even sharpness of the less refrangible edge of the bands, and gradual fading of the more refrangible edge, does not exist with all carbon compounds.

L. M. J.

Cause of Luminosity in the Flames of Hydrocarbon Gases. By Vivian B. Lewes (*Proc. Roy. Soc.*, 1895, **57**, 450—468).—According to the "solid particle" theory of luminosity, it is to be expected that the luminosity of different flames of the same size and burning from the same kind of jet, would be governed (1) by the temperature of the flame; (2) by the number of carbon particles in a given area.

In order to determine the temperatures of different flames, the author has made use of a very small and thin Le-Chatelier thermocouple. Preliminary experiments showed that the diameter of the wire seriously affected the temperature recorded, and the author concludes that the temperatures indicated by the finest wires which can be used without fusing are probably 100—200° too low. The following results were obtained.

	Acetylene.	Ethylene.	Coal gas.
Non-luminous zone......	459°	952°	1023°
Commencement of luminosity................	1411	1340	1658
Near top of luminous zone	1517	1865	2116

As regards luminosity, however, the three gases stand in exactly the reverse order; and as there appears to be no apparent relation between the temperature of the flame, or the probable number of carbon particles contained in it, and its illuminating value, it is suggested that the luminosity must be in great part governed by some thermochemical changes taking place in the flame and yet not appreciably affecting the average temperature. It is thought that as acetylene is formed when hydrocarbons are burnt, and as it is an endothermic substance, the heat liberated during its decomposition endows the carbon particles with a high incandescence. In support of this view, the author shows that acetylene, when decomposed by a detonator or merely by strongly heating it in a glass tube, develops light. It is also shown that acetylene, when largely diluted with hydrogen, carbonic oxide, carbonic anhydride or nitrogen, burns with a non-luminous flame (compare P. Frankland, Trans., 1884, 30 and 227). It has been found possible to make such mixtures burn with luminous flames by externally increasing the temperature.

The luminosity of a flame, therefore, depends not so much on the percentage of acetylene in the gas, but rather as to whether there are many points at which the temperature is sufficiently high to bring about decomposition of the acetylene. The flame of alcohol contains as much acetylene as a good coal gas flame, and yet is non-, or only slightly, luminous, because the temperature is too low to decompose the acetylene. When burnt in oxygen, the flame becomes brightly luminous, owing to the increase in temperature. Cyanogen, which is even more endothermic than acetylene, burns with a non-luminous flame. This is due to the fact that cyanogen requires a much higher temperature before it is decomposed, and it is shown that when sufficiently strongly heated, it can be made to burn with a luminous flame. J. J. S.

Red and Yellow Mercuric Oxides. By WILHELM OSTWALD and THOR MARK (*Zeit. physikal. Chem.*, 1895, **18**, 159—160).—The experiments of Varet proved the identity of the heats of formation of the two mercuric oxides, hence the total energies are equal for these compounds (Abstr., 1895, ii, 305). A galvanic cell of mercury—red oxide—caustic potash—yellow oxide—mercury, was found by the author to give no E.M.F., whilst, also, no change of the E.M.F. of various cells occurred when red and yellow oxides replaced one another. Hence, the author points out, the free energy of the two forms are also equal, and the compounds are not isomeric but identical. L. M. J.

Peroxide Electrodes. By OLIN FREEMAN TOWER (*Zeit. physikal. Chem.*, 1895, **18**, 17—50).—Examination of various peroxide electrodes showed those of lead, silver, and thallium to be unavailable, as with the first a long time is necessary before a constant E.M.F. is obtained, whilst the two peroxides last mentioned are unstable and readily acted on by dilute acid solutions. Manganese peroxide, being free from the above disadvantages, was therefore selected for the experiments. The E.M.F. with this electrode is given by the formula

$$n\epsilon_0\pi = \mathrm{Rt}\log\left(\mathrm{C}_m\mathrm{C}_0^4/\mathrm{C}_{m'}\mathrm{C}_0^4\right),$$

where $\mathrm{C}_m + \mathrm{C}_0$ are the concentrations of the manganese and hydroxyl ions respectively, the other letters having the usual significance. In acid solutions, $\mathrm{C}_0 \times \mathrm{C}_\mathrm{H}$ being constant. k/C_H may be substituted for C_0, and the formula reduces to

$$\pi = -0{\cdot}0286\log\left(\mathrm{C}_m\mathrm{C}_\mathrm{H}^4/\mathrm{C}_{m'}\mathrm{C}_\mathrm{H}^4\right).$$

Experiments were made with solutions of varying nitric acid and manganous nitrate content; the observed and calculated results show satisfactory agreement, the differences being probably due to incomplete dissociation. As theoretically indicated, the effect of the salt concentration was found to be four times that of the acid. Experiments were also made with phosphoric, malonic, tartaric, formic, acetic, salicylic, orthamidobenzoic, mono-, di-, and tri-chloracetic acids, the concordance between the observed and calculated numbers being again, for the most part, satisfactory. The influence of temperature was next determined. This, in the case of nitric and sulphuric acids, is very slight, rather more for phosphoric and the chloracetic acids, and very marked with acetic, formic, and tartaric acids. No reason for these differences is, however, indicated. The determination of the E.M.F. is also employed for the determination of the degree of dissociation of the sodium salts of 16 organic acids at varying concentrations, and the results compared with those obtained by Trevor (Abstr., 1893, ii, 62). The only cases in which satisfactory agreement is not obtained are those of the phthalates and isophthalates, where the author finds the former salt to be the more highly dissociated. Barium salts were also employed in a few cases, and the dissociation is determined for acid sulphates of potassium, magnesium, sodium, aluminium, and copper, hydrogen sodium selenate, and dihydrogen sodium phosphate. In alkaline solutions, the electrolyte is a solution of $Mn(OH)_2$, hence $C_m \times C_0^2 = k$, and $C_mC_0^4 = k/C_0^2$, hence $\pi = -0{\cdot}0286 \log (C_0^2/C_0^2)$. The availability of the formula is shown by experiments with potassium, sodium, barium, strontium, calcium, and ammonium hydroxides. By the use of a perfectly neutral solution, the dissociation of pure water is obtained as $4{\cdot}4 \times 10^{-8}$, a number which, although of the same degree of magnitude, is smaller than that which has been obtained by other methods. L. M. J.

Potential Differences between Metals and Electrolytes. By Georg Meyer (*Ann. Phys. Chem.*, 1895, [2], **56**, 680—699).—Rothmund (Abstr., 1825, ii, 35) has calculated the E.M.F. of various cells from his electro-capillary measurements of the potential differences between the metals and electrolytes composing them, and in a number of cases the values thus obtained do not agree with those directly measured. The author has repeated, and, in general, confirmed Rothmund's measurements. He therefore concludes that the E.M.F. of a cell $M_1 \mid F_1 \mid F_2 \mid M_2$, composed of the metals M_1 and M_2 and the electrolytes F_1 and F_2, is not given by the difference between the forces necessary to produce the maximum surface tension of polarisation of M_1 in F_1 and of M_2 in F_2. The potential difference between the two metals and two electrolytes must be taken into account, and to the difference of E.M.F. above spoken of must be added the potential difference between two dropping electrodes, which, containing M_1 and M_2, are respectively placed in the electrolytes F_1 and F_2. It is only when this last term approaches zero in value that it can be neglected. H. C.

Electro-capillary Properties of Dilute Sulphuric acid. By A. Gouy (*Compt. rend.*, 1895, **121**, 765—768)—The author has made a number of determinations of the relationship between the height h of the column of mercury balanced by electro-capillary forces, and the difference of potential V between the mercury and the electrolyte, using solutions of sulphuric acid of various concentrations as the electrolyte. The values of h decrease with the concentration of the solution, but, in the more concentrated solutions, exact measurements become impossible, owing to the occurrence of electrolysis. The second derived function d^2h/dV^2 is always negative, so that the curve of h has no point of inflexion, and does not tend to any limiting value. The actual value of the function is not constant, but is subject to complex variation. H. C.

The Passage of Electricity through Gases. By Otho Lehmann (*Zeit. physikal. Chem.*, 1895, **18**, 97—117).—Experiments are described on the electric discharge through various gases, vacuum tubes, mixed gases with different forms of electrodes, and the discharge in a strong magnetic field. The paper is illustrated by a number of figures of discharge phenomena, and the author considers the views of Goldstein and Hertz, that the discharge takes place into the ether and not into the gas, to be erroneous. L. M. J.

Relation between the Dielectrical Constants of Gases and their Chemical Valency. By ROBERT LANG (*Ann. Phys. Chem.*, 1895, [2], **56**, 534—545).—Between the dielectrical constant, K, of a gas, that of the ether being unity, and the sum of the valencies of the atoms in the molecule of the gas, s, the author finds that there is the following general relationship.

$$\frac{K-1}{s}10^6 = 123.$$

This relationship does not always hold if the simple chemical molecule of the gas is taken, but, in such cases, the assumption is made that a number of these molecules are combined to form a complex group, when agreement is obtained. The values of K are taken for 0° and 760 mm. pressure. The term *dielectrical valency constant* is proposed for the constant, the value given above for this being provisional only. H. C.

Determination of High Resistances. By MARGARET E. MALTBY (*Zeit. physikal. Chem.*, 1895, **18**, 133—158).—A method for the determination of high electrolytic resistances is described, previous methods being considered unsatisfactory. A Wheatstone bridge is employed with four carefully calibrated adjustable electrolytic resistances, and when a balance is obtained, the unknown resistance is placed in one arm (1) in series (2) parallel, and that resistance again adjusted for a balance. Full details of the construction, calibration, and working of the instruments are given in the paper. Comparison of numbers obtained with those due to Kohlrausch indicates the availability of the method. Experiments are recorded with a solution of hydrogen chloride in ether at its critical temperature, the resistance increasing from 641 divisions at 20° to 24,180 at 197°, at which temperature critical phenomena were observed. Solutions of trichloracetic acid in ether, and of potassium chloride in water, were also examined at high temperatures. The former gave a continuous decrease until 75°, when the resistance commenced to increase; with the latter salt, the resistance decreased regularly to 297°. The method is stated to be available for the determination of the conductivity of pure water, but no measurements are recorded. L. M. J.

Determination of some Conductivities. By A. E. BAUR (*Zeit. physikal. Chem.*, 1895, **18**, 183—184).—The conductivity of tetrazole compounds was first examined with the following results: Tetrazole, CN_4H_2, $\mu_{1024} = 37\cdot96$; amidotetrazotic acid, $C_2H_6N_{10}$, $\mu_{1024} = 11\cdot61$; sodium azotetrazole, $C_2N_{10}Na_2,5H_2O$, $\mu_{1024} = 103\cdot6$; sodium amidotetrazotate, $CH_2N_5Na,3H_2O$, $\mu_{1024} = 93\cdot27$. The conductivities of the chlorates of cæsium, rubidium, and potassium were found to be 137·5, 134·9, and 129·9 respectively (μ_{1024}), and hence, taking the ion velocity of potassium as 70·6 and $\mu_\infty = \mu_{1024} + 3$, the following ion velocities are obtained: Rb, 75·6; Cs, 78·2; ClO_4, 62·3. The values of the velocities of the metallic ions were also determined by means of the chlorides with the results Rb, 76·5; Cs, 79·3. L. M. J.

The Dilution Law of Salts. By JACOBUS H. VAN'T HOFF (*Zeit. physikal. Chem.*, 1895, **18**, 300—304).—Rudolphi found (Abstr., 1895, ii, 490) that the relation between the molecular conductivity and the concentration is given by the expression $k = \frac{(\lambda_v/\lambda_\infty)^2}{\sqrt{v}(1 - \lambda_v/\lambda_\infty)}$ instead of by Ostwald's expression $k = \frac{\lambda_v/\lambda_\infty}{v(1 - \lambda_v/\lambda_\infty)}$. The author shows that in Rudolphi's experiments a slightly better constancy of k is obtained by the expression $\frac{(\lambda_v/\lambda_\infty)^{\frac{3}{2}}}{\sqrt{v}(1 - \lambda_v/\lambda_\infty)}$, which leads immediately to the equation c_i^3/c_s^2 = constant where c_i and c_s are the concentrations of ions and non-dissociated substance respectively, although, as the author points out, the physical interpretation is not very clear. L. M. J.

Specific Heat of Mercury between 0° and 30°. By ADOLFO BARTOLI and ENRICO STRACCIATI (*Gazzetta*, 1895, **25**, i, 380—388). —After a summary of the work previously done, the authors give an account of their determination of the specific heat of mercury between 0° and 30° made by cooling a mass of platinum, previously heated in a steam bath, in water, and in pure mercury, successively; using the values for the specific heat of water previously obtained by them (Abstr., 1895, ii, 5), the specific heat of mercury between 0° and 30° is given by the equation

$$C = 0·033583 + 0·00000117\ T - 0·0000003T^2,$$

in which T is the temperature for which the specific heat C is required. The numbers agree well with those obtained by Naccari and by Winkelmann. W. J. P.

Specific Heats of Platinum, Silver, Tin, Lead and Copper. By ADOLFO BARTOLI and ENRICO STRACCIATI (*Gazzetta*, 1895, **25**, i, 389—393; compare preceding abstract).—The authors have obtained the following values for the specific heats of various metals between 15° and 100° as the means of a large number of measurements; the values are referred to water at 15°, and the impurities are given in percentages.

Platinum	(containing traces of Ir)	0·032238
Silver	(„ 0·047 Cu and 0·016 Au) ..	0·056250
Tin	(„ 0·030 Fe and 0·008 Pb) ..	0·055550
Lead	(„ 0·030 Tl and traces of other metals)	0·030887
Copper	(„ 0·12 Sn and 0·12 Au)	0·093392
„	(„ 0·005 Sn and traces of other metals)	0·093045

W. J. P.

Latent Heats of Vaporisation of Ketones and other Carbon Compounds. By WLADIMIR F. LOUGUININE (*Compt. rend.*, 1895, **121**, 556—558).—In the following table, column I contains the boiling point under a pressure of 760 mm., column II the latent heat of vaporisation, and column III the value of the constant in Trouton's expression MS/T = constant, where M is the molecular weight, S the latent heat of vaporisation, and T the boiling point on the scale of absolute temperatures.

	I.	II.		III.
Dipropyl ketone	143·90°	75·94	Cal.	20·76
Methyl butyl ketone	127·61	82·91	"	20·70
Diethyl ketone	102·46	90·54	"	20·74
Methyl isopropyl ketone	94·04	88·67	"	20·78
Methyl ethyl ketone	79·54	103·44	"	21·13
Decane	159·45	60·83	"	19·98
Octane (normal)	124·90	70·92	"	20·32
Diethylic carbonate	126·28	72·80	"	21·53
Dimethylic carbonate	90·30	87·87	"	21·76

These results, with those of previous observers, show that in each group of compounds the value of MS/T is almost constant, whilst it differs considerably in different groups. Ostwald has already pointed out that this expression makes it possible to calculate the latent heat of vaporisation with a probable error of not more than 15 per cent. Since, however, the variations in its value are very small in a group of homologous and isomeric compounds, the latent heats of vaporisation of all the members of a series can be calculated with an error of not more that 1 to 1·5 per cent., when the value has been experimentally determined for one member of the series. C. H. B.

Determination of Transition Points. By A. E. BAUR (*Zeit. physikal. Chem.*, 1895, **18**, 180—182).—The transition temperature was determined by the electrical method of Cohen and Bredig (Abstr., 1894, ii, 407) in the change

$$Na_2HPO_4,12H_2O \rightarrow Na_2HPO_4,7H_2O,$$

and the method was used to investigate the cause of the colour change experienced by the solution of the double salt $HgI_2,2AgI$ at about 50°. The transition temperature in the first case was found to lie between 36·5 and 36·8, whilst in the second case the colour change from yellow to red is due to the formation of mercuric iodide owing to the decomposition of the double salt. L. M. J.

Improved Calorimeter for the Application of the Method of Mixtures. By F. A. WATERMAN (*Phil. Mag.*, 1895, [5], **40**, 413—421).—For the purpose of avoiding the radiation correction in the determination of the specific heat of solids by the method of mixtures, Hesehus has suggested that the calorimeter cup be introduced into the bulb of an air thermometer and maintained at a constant temperature by the introduction of a sufficient amount of cold water, of known temperature, immediately after the introduction of the heated solid. By this means, both the radiation correction and the water equivalent of the calorimeter cup are avoided, the heat received by the cold water being equal to that given out by the heated substance.

The author has constructed a calorimeter on the above principle. The water cooler and dropper is supported upon a vertical rod in such a manner that it may be quickly turned about the rod as an axis, and may deliver water directly to the calorimeter cup. An electric heater is supported upon a second vertical rod and may be turned about the rod as an axis until it is directly over the calorimeter cup, allowing the heated body to be transferred directly to the cup. A summary of some trial determinations made with this apparatus is given, showing that it gives concordant results. H. C.

Thermal Unit. By Ernest H. Griffiths (*Phil. Mag.*, 1895, [5], **40**, 431—454).—The capacity for heat, of water, has been invariably adopted in defining the thermal unit, and its capacity at 0°, 4°, 15°, and its mean capacity from 0° to 100°, have been variously selected as standards by different observers. This selection is unfortunate, as at present our knowledge of the comparative value of these standards is vague, and comparison of the results of the different investigators becomes impossible. The range 10° to 30° is of particular importance, as the majority of thermal determinations are expressed in terms of the capacity of water at some point within this range, and as a consequence great attention has been devoted to it; but in spite of this, a comparison of the results of those observers whose work appears to be most worthy of attention, shows that a discrepancy which may be as great as 1 in 300 exists between their results. Even greater uncertainty attaches to the determination of the "mean calorie," as the determinations of the ratio of the mean calorie to the thermal unit at 15°, give results varying from 1·013 to 0·9957, a difference of 1 part in 60. It appears, therefore, that the endeavours to establish the heat capacity of water as the standard of calorimetric measurements have, so far, not met with success.

It has been pointed out by Gray, that even if the specific heat of water was accurately known it would not, for any reason, be arithmetically commensurable with any other definite physical quantity, but it would be a purely arbitrary quantity. But it is evident that the ideal thermal unit should be a natural, not an arbitrary, one, and have some real relation with other units of energy. Further, it should not be dependent on the observations or conclusions of any one investigator; it should be of a convenient magnitude, and should cause as little disturbance as possible in the numerical values resulting from our present system of thermal measurements. The author proposes that the value of this ideal unit should be first defined, that value being some convenient multiple of an absolute unit. A first approximation could then be made to the physical unit thus selected, and this improved, if necessary, by subsequent measurements. It is proposed that the unit adopted should be a thermo-dynamic one, and that this ideal unit should be termed a "Rowland." The name

"Therm" is taken to indicate the quantity of heat required to raise 1 gram of water (measured in vacuum) through 1° of the nitrogen thermometer at a temperature t° of that thermometer. The Rowland should be of such a magnitude that a therm at some convenient temperature would be its heat equivalent. The particular therm which is the exact equivalent of a Rowland could be denoted by the phrase "standard therm."

(This paper was read at the 1895 meeting of the British Association. The consideration of the whole matter has been referred to the Committee on Electrical Standards.) H. C.

Heats of Combination of Substances in the Liquid and Solid Conditions. By P. Spencer U. Pickering (*Phil. Mag.*, [5], **39**, 510).—The author has investigated several so-called molecular compounds to ascertain whether, as in the case of the monhydrate of sulphuric acid, their heats of formation were the same in both solid and liquid conditions. Their heats of combination as liquids were determined directly, and the value for the solids deduced indirectly from the heats of fusion of the constituents and compounds. The heat capacities of the substances in both conditions had also to be determined in order to reduce the heats of fusion to the same temperature. The heat of combination thus calculated is, however, the true heat of combination only if the heat of fusion of the compound is equal to the sum of those of its constituents, and the results obtained by the author prove that this is not the case, the heat of fusion of the compound being generally the smaller quantity. The true heat of combination in the solid condition can, therefore, not be obtained.

The substances investigated were: Compounds of sulphuric acid, pinacone, stannic bromide, and sodium hydroxide with water; benzene with azobenzene; and dinitro- and meta-dinitrobenzene with naphthalene. The existence of the two last-mentioned compounds was investigated and established by series of freezing point determinations; so also was the existence of the octohydrate of stannic bromide, which had not before been isolated. S. U. P.

Combination of Mercuric Cyanide with Iodides. By Raoul Varet (*Compt. rend.*, 1895, **121**, 499—501).—The first column gives the heat of dissolution of the salt in water; the second, the heat developed on mixing solutions of mercuric cyanide and the particular iodide; and the third the heat of formation of the solid salt from its proximate constituents (solid salts and liquid water).

	1.	2.	3.	
$Hg(CN)_2,2NaCN,HgI_2,4H_2O$	−22·8	+5·3	+24·7	Cal.
$Hg(CN)_2,2NH_4I,HgI_2,\frac{1}{2}H_2O$	−23·5	+4·5	+15·0	„
$Hg(CN)_2,2LiCN,HgI_2,7H_2O$	−20·7	+5·5	+50·0	„
$Hg(CN)_2,Ba(CN)_2,HgI_2,6H_2O$ ..	−22·0	+5·3	+31·6	„
$Hg(CN)_2,Sr(CN)_2,HgI_2,7H_2O$ ..	−21·8	+5·5	+41·8	„
$Hg(CN)_2,Ca(CN)_2,HgI_2,7H_2O$ ..	−22·4	+5·5	+49·5	„
$Hg(CN)_2,Mg(CN)_2HgI_2,8H_2O$ ..	−20·0	+5·3	+69·1	„
$Hg(CN)_2,Cd(CN)_2,HgI_2,8H_2O$ ..	−22·5	+2·0	+17·3	„

At 30°, the solutions of the iodocyanides, unlike those of the chloro-cyanides and bromocyanides (this vol., i, 3; ii, 88), are strongly alkaline to litmus, and give the isopurpurate reaction with picric acid, and hence it follows that they contain salts of the type $Hg(CN)_2,M''(CN)_2,HgI_2$. The conversion of the system $2Hg(CN)_2 + M''I_2$, into $Hg(CN)_2 + M''(CN)_2 + HgI_2$, absorbs about −9·3 Cal. in solution, whilst the heat of formation of the double cyanides, $Hg(CN)_2,M''(CN)_2$, is +12·4 Cal., and their union with yellow mercuric iodide develops +2·3 Cal. C. H. B.

Lithium, Magnesium, and Copper Cyanides. By RAOUL VARET (*Compt. rend.*, 1895, **121**, 598—599).—*Lithium Cyanide.*—The heat of neutralisation of hydrocyanic acid solution by lithia is +5·85 Cal., and hence

Li sol. + CN gas + Aq = LiCN diss... develops +65·12 Cal.

Magnesium Cyanide.—The heat of neutralisation [$Mg(OH)_2$] is +3·0 Cal., and hence

Mg sol. + 2CN gas + aq. = $Mg(CN)_2$ diss. .... develops +112·0 Cal.

Cuprous Cyanide.

$Hg(CN)_2$ diss. + Cu_2I_2 sol. = HgI_2 (red) + $Cu_2(CN)_2$ .... develops +12·8 Cal.
Cu_2O sol. + 2HCN diss. = $Cu_2(CN)_2$ sol. + H_2O liq. .... " +28·8 "
Cu_2 sol. + 2CN gas = $Cu_2(CN)_2$ sol..... " +29·8 "

Hydrogen cyanide displaces hydrogen chloride from cuprous salts with development of +13·6 Cal., and hydrogen bromide with development of +10·8 Cal., but is displaced by hydrogen iodide with development of +3·2 Cal. These phenomena are analogous to those observed by Berthelot with mercuric oxide, and by the author with mercurous oxide; but whereas mercuric and mercurous oxides behave similarly, cupric oxide differs from cuprous oxide in that the heats of neutralisation of the former by hydrogen chloride, bromide, and iodide are practically identical. C. H. B.

Depression of the Melting Point of Sodium Sulphate by the addition of Foreign Substances. By RICHARD LÖWENHERZ (*Zeit. physikal. Chem.*, 1895, **18**, 70—90).—The effect of non-electrolytes in lowering the melting point of sodium sulphate was first determined, urea, glycocine, cane sugar, formamide, and glycerol being employed, and the mean value for the depression constant so obtained was 32·6. The effect of sodium salts was next investigated, and, as might be expected, they behaved practically as non-electrolytes, sodium phosphate giving the highest value (37·8), whilst the results indicate that the formula of sodium persulphate is $Na_2S_2O_8$. By the addition of sulphates (those of potassium, ammonium, and lithium), a double depression constant results. This may due either to dissociation into K and KSO_4 ions, since neither of these is present in the solvent, or to an interaction; $K_2SO_4 + Na_2SO_4 = 2KNaSO_4$. Potassium chloride and nitrate gave double values, which may be explained either by dissociation or interaction with the sodium sulphate, whilst potassium chromate and potassium carbonate gave depression constants equal to three times the normal, and capable of a similar explanation. By the determination of the solubility of sodium sulphate in (1) water, and in (2) a solution of urea, the temperature of transition to the anhydride was found to be (1) 32·46, (2) 29·26, the numbers obtained by the direct determinations being 32·39 and 29·26. The depression constant is calculated by use of the formula $k = 0{\cdot}02TW/$, and by Raoult's tension law, the values 36 and 33·8 being so obtained.

L. M. J.

Pressures of Saturation of Oxygen. By THADDEUS ESTREICHER (*Phil. Mag.*, 1895, [5], **40**, 454—463).—The author has measured the temperatures of the saturated vapour of oxygen under pressures lower than one atmosphere by means of a hydrogen thermometer. Three series of determinations were made, and the results, which are generally in close agreement with one another, are given in separate tables in the paper. The value of f in the Van der Waal's formula was calculated and compared with that given by a number of other associating and non-associating liquids at low pressures (compare Guye, Abstr., 1895, ii, 153). The mean value for oxygen is about 2·45.

The author finds that the value of f always decreases with increase of temperature, both for associating and non-associating substances. The association of the molecules of the liquid has an influence on f, but is not the only reason of its increasing. Of 10 ethereal salts, six have values of f much higher than 3·06, although, according to Ramsay and Shields, they are not associated. Perhaps there is some relationship with the molecular weight, as the highest of the alcohols examined, isobutylic alcohol, has the highest f.

H. C.

Thermal Properties of Vapours: Alcohol Vapour and its Relationship to the Laws of Boyle and Gay-Lussac. By ANGELO BATELLI (*Ann. Chim. Phys.*, 1895 [7], **5**, 256—275).—The pressure of saturated ethylic alcohol vapour shows at high temperature a behaviour similar to that which the author has observed in several other substances, the pressure increasing as condensation proceeds and the liquid accumulates. The maximum pressures between the temperatures −16° and 240° may be represented by the formula of Biot,

$$\log p = a + b\alpha^t + c\beta^t,$$

the values of the constants being

$$\begin{array}{lll} a = 5{\cdot}0751023 & & \\ b = 0{\cdot}0435271 & \log b = \bar{2}{\cdot}6387597 & \log \alpha = 0{\cdot}00336681 \\ c = -4{\cdot}0217800 & \log c = 0{\cdot}6044184 & \log \beta = \bar{1}{\cdot}99683015 \end{array}$$

The critical constants obtained from the isothermal curves are: $t_c = 241{\cdot}4°$, $p_c = 47{,}348$ mm., and $v_c = 4{\cdot}38$ c.c. The coefficients of dilatation of alcohol vapour under constant pressure increase as the temperature diminishes, this taking place the more rapidly the nearer the vapour is to the point of liquefaction. The absolute values of the coefficients and their variations between the same limits of temperature increase with the increasing pressure of the vapour. From the isochoric curves, the values of dp/pdt, the coefficient of pressure change at constant volume, were calculated. The coefficient decreases with rising temperature, the variations becoming more marked the smaller the volume. As the volumes increase, the absolute value of the coefficient diminishes. The formula of Clausius in the modified form,

$$p = \frac{RT}{v - a} - \frac{mT^{-\mu} - nT^{\nu}}{(v + \beta)},$$

applies very closely to the results obtained with alcohol. H. C.

Vapour Pressure of Concentrated Solutions of several Salts, especially Lithium and Calcium Nitrates. By John Waddell (*Chem. News*, 1895, **72**, 201—203).—Into a wide-mouthed, closely stoppered bottle of about 200 to 300 c.c. capacity three small test-tubes were introduced, one of which contained water or alcohol, and each of the others one of the salts to be experimented with. After some experience had been gained, the liquid was frequently added directly to the salts, and the third test-tube dispensed with. The salts were taken in molecular proportions, weighed in milligrams, but 1, 2, or 4 mols. of one salt were taken to 1 mol. of the other, the numbers obtained being all so reduced as to show the quantity of liquid taken up per molecule of each salt.

Experiments were first made with calcium and lithium nitrates. If a curve is plotted whose ordinates are the quantities of water absorbed respectively by the lithium and the calcium nitrate, it does not differ very much from a straight line, although it is slightly concave towards the axis of the lithium nitrate. The ratio of the water absorbed by the lithium nitrate to that absorbed by the calcium nitrate ranged from about four-fifths to five-sixths. As, if all the molecules of each salt were dissociated into their ions, there would be the same vapour pressure when the amount of water absorbed per molecule by the lithium and calcium nitrates is in the ratio 2 : 3, it may be assumed that the lithium nitrate is dissociated to a greater extent than the calcium nitrate. When alcohol was employed as the liquid to be absorbed, there was less uniformity than in the case of water. Each molecule of lithium nitrate absorbs approximately four-fifths as much alcohol as each molecule of calcium nitrate. This condition would be fulfilled if all the lithium nitrate were dissociated, and one quarter only of the calcium nitrate molecules. A series of experiments was instituted for the purpose of comparing the nitrates of the calcium group of metals among themselves and with lithium nitrate. This has not been quite completed, but there seems to be little doubt from what has been done, that barium nitrate is the most absorbent, that the calcium salt comes next, and that the strontium compound, instead of being intermediate between the others, is less absorbent than either. A series of experiments was also made in which the metal was the same, but the salt radicle varied, the haloïd salts of potassium being chosen for this purpose. The bromide and iodide both absorb enough water to make a solution while the chloride is still in the solid condition, but when the vapour pressure from the bromide and iodide comes to be as great as that of the saturated solution of the chloride, it remains constant until the chloride is all dissolved. Therefore, the three salts absorb nearly the same amounts of water, and it appears that these salts are very nearly equally dissociated, even in rather concentrated solutions, but if anything, the bromide is more dissociated than the others.

Experiments on the resistance of the solutions showed that the amount of dissociation of calcium nitrate is about 45 per cent. as great in a concentrated as in a dilute solution, whilst the amount of dissociation in the case of the lithium salt is about 83 per cent.

H. C.

Determination of the Molecular Weights of some Inorganic Substances. By HEINRICH BILZ (*Chem. Centr.*, 1895, i, 770—771; from *Math. natw. Mitt. Berlin*, 1895, 35—38).—The author has determined the density of some of the elements at a very high temperature by means of an apparatus made of a highly refractory porcelain. The experiments with arsenic, thallium, cadmium, and zinc were made at 1732—1748°. The density of arsenic vapour was found to be 5·30—5·54, the theory for As_2 being 5·2. The dissociation at this high temperature was not greater in hydrogen than in nitrogen. Thallium showed a density of 14·77, theory for Tl_2 requiring 14·11. Cadmium had a density of 4·34—4·38, theory requiring 3·87 for Cd. Zinc had a density of 2·64, theory requiring 2·25 for Zn. Iridium and tin did not evaporate at these high temperatures.

Arsenic trioxide has, between 500—770°, a density corresponding with the formula As_4O_6. The same diminishes with a higher temperature, and has, at 1732°, the value 7·32, theory for As_2O_3 requiring 6·84. It seems that, above 1770°, only molecules of the compound As_2O_3 can exist. The increase in the boiling point of aqueous solutions of both varieties of arsenious anhydride showed that decomposition into 2 mols. of arsenious acid, H_3AsO_3, had occurred. The solution of the crystallised variety of arsenious anhydride in nitrobenzene seems, on the other hand, to contain unaltered As_4O_6.

Attempts were made to estimate the vapour density of the alkali metals and of magnesium, but constant values could not be obtained although any action of the metals on the porcelain vessel was prevented.

L. DE K.

Specific Volume and the Genesis of the Elements. By CHARLES T. BLANSHARD (*Chem. News*, 1895, **72**, 230—231, 237—238).—Continuing his observations in reference to the genesis of the elements (Abstr., 1895, ii, 340), the author now points out that the specific volumes in certain homologous series of organic compounds offer parallels to various conditions that obtain with the atomic volumes of series of related elements.

D. A. L.

Molecular Volumes. By ISIDOR TRAUBE (*Ber.*, 1895, **28**, 2722—2728; compare Abstr., 1895, ii, 209).—The author compares the observed and calculated values (Abstr., 1895, ii, 70) of the molecular solution volumes of a large number of organic compounds of very different types, and finds a very close agreement between them; he gives a revised table of atomic solution volumes for the non-metallic elements, and states that the molecular contraction volume per gram-molecule of substance dissolved in water should be 13·5 c.c. instead of 12·2 as previously given. The molecular solution volume is not a purely additive property, but a highly constitutive one, the atomic solution volumes for the various types of oxygen, carbon, nitrogen, sulphur, &c., in organic compounds having very different values; the presence of a benzene or hexamethylene ring in the molecule decreases the molecular solution volume of the compound by 8·1 c.c. The molecular solution volume is not simply the sum of the atomic solution volumes of the atoms forming the molecule, as an expansion always occurs during the formation of a substance; this "molecular dilatation" is approximately the same for all substances, and is 12·4 c.c. per gram molecular weight for the gram molecular volume in aqueous solution at 15°; to obtain the molecular volume this number 12·4 must naturally be increased by the addition of 13·5 c.c.; the molecular contraction volume for water thus becomes 25·9 c.c.

W. J. P.

Molecular Volumetric Determination of Molecular Weights. By Isidor Traube (*Ber.*, 1895, **28**, 2728—2730; compare preceding abstract).—From a single specific gravity determination of an aqueous solution containing 0·5—3 per cent. of a substance, the molecular solution volume of the latter can be calculated, and a correct molecular weight assigned to the substance, using the equation (Abstr., 1895, ii, 70)—

$$v_m = m + aq/d - aq/\delta = \Sigma n\mathrm{C} + 12{\cdot}4.$$

The influence of ionic dissociation and of the presence of the various types of ring present in the substance must, of course, be taken into consideration.

In determining the molecular weight of an acid, it is usually convenient to neutralise the solution with standard soda, using phenolphthaleïn as an indicator, and to then determine the molecular solution volume of the sodium salt, which in so dilute a solution is practically wholly dissociated. The molecular solution volume of sodium metamidobenzoate determined in a 3·030 per cent. aqueous solution was found to be 89·1 c.c., whilst the calculated value is 89·2 c.c.; very accurate results may therefore be obtained.

W. J. P.

Molecular-volumetric Method of Determining the Molecular Weight and Constitution. By Isidor Traube (*Ber.*, 1895, **28**, 2924—2928).—The author gives the following formula for calculating the molecular volumes of the hydrocarbons at 15°.

$$\mathrm{V}_m = \Sigma n\mathrm{C} + 25{\cdot}9 - (p\mathrm{R} + q|^{=} + r|^{\equiv}),$$

where $\Sigma n\mathrm{C}$ is the sum of the products of the atomic volumes and the number of atoms present, and p, q, r are respectively the number of rings, of double, and of triple linkings. The atomic volume of carbon is 9·9, of hydrogen 3·1, the decrement for each hexamethylene ring 8·1, for each benzene ring 13·2, for each double linking 1·7, and for each triple linking 2 × 1·7 = 3·4. The molecular volumes of 80 hydrocarbons calculated by this formula are given in the paper and compared with those obtained directly from the specific gravities. The agreement between the two series is excellent, and in no case is a greater difference than 6·3 c.c. observed. Since doubling the molecular weight would cause a difference of 25·9 c.c., the application of the method to the determination of molecular weights is evident (compare Abstr., 1895, ii, 209). H. C.

Initial Rates of Osmosis of certain Substances in Water and in Liquids containing Albumin. By W. S LAZARUS-BARLOW (*J. Physiol.*, 1895, **19**, 140—166).—See this vol., ii, 196.

Correct Formulæ for Osmotic Pressure, Changes of Solubility, Freezing Point and Boiling Point; and Heats of Solution and Dilution in Dissolved Dissociated Substances. By J. J. VAN LAAR. II. (*Zeit. physikal. Chem.*, 1895, **18**, 245—282).—The author investigates, thermodynamically, the above formulæ, and obtains theoretically the following results. If a strongly dissociated compound is added to a dilute solution of a feebly dissociated substance with one common ion, the dissociation degree of the former remains almost unaltered, that of the latter compound being diminished. When also there is one ion common, the solubility of the compound is lowered, the least soluble undergoing the greatest relative change. Non-electrolytes do not affect the solubility, neither are they affected in this respect. When there is no common ion, the effects are more complicated, and frequently undetermined. In the case of partition coefficients between water and other solvents, it is seen that, owing to the ions being absent in the other solvents, the apparent partition coefficient increases with dilution. The effect of association of the solvent molecules on the formulæ deduced here and in the former paper (1895, ii, 107) is considered, and, where necessary, alterations for this given. It is also shown that the vapour pressure of water is not influenced by the presence of indifferent gases, and that the validity of Dalton's law is limited to the cases where the volume is great. L. M. J.

The Absorption of Nitrous Oxide in Water and in Salt Solutions. By VICTOR GORDON (*Zeit. physikal. Chem.*, 1895, **18**, 1—16).—The author has determined the absorption coefficient of nitrous oxide in solutions of chlorides of potassium, sodium, lithium, calcium and strontium, and sulphates of potassium, sodium, lithium, and magnesium. The experiments were in each case performed for three or more concentrations, and at five different temperatures, ranging from 8·1° to 22·3°, and interpolation formulæ* are given for each solution examined. The lowering of the absorption coefficient appears to be proportional to M^1, where M is the number of gram molecules of dissolved salt per litre, so that $(a-a_s)/M^1 =$ const., a and a_s being the coefficient in water and the solution respectively. The value of the constant decreases as the temperature rises, and varies with different salts. For analogous salts, however, the constants are nearly equal, whilst the value for bivalent salts is double that for univalent salts. L. M. J.

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* It is noticeable that these interpolation formulæ are in all cases of the form $\alpha = a - \beta t + \gamma t^2$ indicating, if the formula holds for extrapolation, a minimum at the temperature $\beta/2\gamma$, which in almost all cases lies between 34° and 40°.

The Partition Coefficients of Solutions in Liquid and Solid Substances. By JACOBUS M. VAN BEMMELEN (*Zeit. physikal. Chem.*, 1895, **18**, 331—334).—The results and conclusions of G. C. Schmidt (Abstr., 1895, ii, 39) are contested. Neither in silicic acid nor in any other substance experimented with by the author, did he find the absorption took place in accordance with Henry's gaseous law ($c_2/c_1 =$ const., where c_2 and c_1 are the concentrations of dissolved substance in the liquid and solid respectively). The partition coefficient was in all cases not constant, but a complex function of the concentration, and dependent on the temperature and modification of the colloïd. The coefficient is only approximately constant when the concentration is small, so that the author considers Schmidt's conclusions erroneous. L. M. J.

Note by Abstractor.—The partition coefficient should, however, only be constant when the solid absorbent, that is, the colloïd, remains of the same modification, and only for dilute solutions, as in strong solutions Henry's law could not be expected to hold.

Self-recorded Breaks in the Properties of Solutions. By P. SPENCER U. PICKERING (*Phil. Mag.*, [5], **40**, 472—476).—By running a continuous stream of sulphuric acid into water in a calorimeter, and making a chart of the motion of the thermometer, either by photography or by taking successive readings, a diagram is obtained which reproduces automatically the sudden changes of curvature shown by the author's heat of dissolution determinations (Trans., 1890, 127). By adjusting the initial temperature suitably, the figures obtained are rectilineal, and the breaks become as clearly visible as those which are made on starting or stopping the stream of acid. S. U. P.

Cryoscopic Relations of Dilute Solutions of Cane Sugar and Ethylic Alcohol. By HARRY C. JONES (*Phil. Mag.*, 1895, [5], **40**, 383—393; and *Zeit. physikal. Chem.*, 1895, **18**, 283—293).—Nernst and Abegg (Abstr., 1895, ii, 155) have attributed the high results obtained by the author for the molecular lowering of the freezing point in dilute cane sugar solutions to the use of a jacket at a much lower temperature than the freezing point of the solution. The experiments have therefore been repeated, using a freezing mixture from 0·3° to 0·4° colder than the freezing point of the solution. A large volume of solution (1100 c.c.) was employed, thus diminishing very greatly the effect of disturbing influences from without. The stirring was carried out so gently that errors from this source could not have assumed any appreciable dimensions. The results obtained are as follows.

Grams in litre.	Normal.	Lowering found.	Gram-mol. lowering.
3·8875	0·01136	0·0251	2·21
7·775	0·0227	0·0475	2·09
15·550	0·0455	0·0915	2·01
23·325	0·0682	0·1333	1·95
31·100	0·0909	0·1734	1·91

The molecular lowerings are throughout somewhat lower than those obtained in former determinations, but they are still far above the theoretical value. Dilute solutions of ethylic alcohol gave similar results, and the author does not find sufficient justification for the conclusion that non-electrolytes in fairly dilute solutions give lowerings which conform to the equation $t = 0·02\ T^2/W$. H. C.

Relations between the Cryoscopic Behaviour of the Phenols and their Constitution. By KARL AUWERS (*Ber.*, 1895, **28**, 2878—2882).—Although, as the result of former investigations (Abstr., 1894, ii, 133; 1895, ii, 41), the author was led to conclude that the cryoscopic behaviour of the phenols in benzene solution was normal, certain irregularities observed with paracresol and paranitrophenol rendered this conclusion doubtful. The author has, therefore, submitted this point to the test of further experiment, but, as many of the phenols are only very slightly soluble in benzene at the freezing point, naphthalene has been substituted for benzene as a solvent. Forty-eight phenols were examined in all, namely, phenol and 6 of its homologues, 5 halogen derivatives, 9 nitrophenols, 8 hydroxyaldehydes, 14 phenolcarboxylic acids, and 5 polybasic phenols. The acids were used in the form of their methylic or ethylic salts.

The examination of these substances shows that the cryoscopic behaviour of the phenols is largely dependent on their constitution. Phenols, where substitution is in the ortho-position, exhibit the normal cryoscopic behaviour, but para-substituted phenols behave abnormally. The meta-compounds occupy a position between the ortho- and para-, but rather resemble the para-compounds in their behaviour. Among the substituting groups, the influence of the aldehydic group ·CHO is the most marked, and then in decreasing order of influence follow the carboxalkylic group ·COOR, the nitro-group, the halogens, and, lastly, the alkylic groups. The influence of ortho-substitution is stronger than that in the meta- or para-position, so that if a phenol contains the same substituting group in both the ortho- and para-positions, the cryoscopic behaviour of the substance will probably be nearly normal. No exceptions to the above regularities have as yet been met with, and it is suggested that the cryoscopic behaviour of a phenol may aid materially in the determination of its constitution.

H. C.

Cryoscopic Behaviour of Substances having Constitutions similar to that of the Solvent. By EMANUELE PATERNÒ (*Gazzetta*, 1895, **25**, i, 411—417).—Garelli and Montanari (Abstr., 1895, ii, 205) showed that the phenols when dissolved in the corresponding hydrocarbons give abnormal depressions of the freezing points, and conclude that this is due to the close chemical relationship existing between the solvent and the dissolved substance; the author shows, however, that this similarity of constitution is not the only cause of a small depression of the freezing point, but that the chemical nature of the dissolved substance has also to be considered. Thus, phenol behaves abnormally, whether dissolved in benzene or in paraxylene; paraxylenol also gives abnormal freezing point depressions both in paraxylene and benzene solutions; the similarity of constitution of the solvent and dissolved substance seems in these cases to be without effect. Determinations of the depression in freezing point caused by phenol and benzylphenol in diphenylmethane solution show that phenol behaves fairly normally and benzylphenol quite abnormally, as would be expected from Garelli and Montanari's conclusion.

W. J. P.

Freezing of Solutions at Constant Temperature. By Albert Colson (*Compt. rend.*, 1895, **120**, 991—993).—An increase of pressure raises the freezing points of liquids which contract during solidification, whilst, on the other hand, the presence of dissolved foreign matter lowers the freezing point in inverse proportion to the molecular weight of the dissolved substance. The author has endeavoured to ascertain experimentally whether any relation exists between the molecular weight of the dissolved substance and the pressure required to maintain the freezing point of the solvent constant. The solvent selected was benzene freezing at 5·7°. The results are given in the following table.

Dissolved substance.	M.	*p*.	*t*.	P.
Benzoic acid	122	2·5	0·53°	98 mm.
Acetic acid..........	60	2·5	1·16	232 „
Naphthalene.........	128	2·5	1·06	219 „
Paradichlorobenzene..	137	2·5	0·92	180 „
Paradichlorobenzene..	137	5·0	1·85	410 „
Metadinitrobenzene ..	168	3·0	0·98	225 „

Here M is the molecular weight of the dissolved substance, *p* the number of grams dissolved in 100 grams of benzene, *t* the depression of the freezing point, and P the pressure in mm. in Amagat's apparatus required to raise the freezing point of the solution to that of the solvent (5 mm. on this scale correspond with about 1 atmos.). It will be seen that in the case of benzoic and acetic acids there is no direct relationship between the pressures corresponding with a particular freezing point depression and the molecular weights of the acids. On the other hand, if we consider three of the solutions in which the depression of the freezing point is about 1°, we find that the pressure which may be regarded as equivalent to a depression of 1° is in each case about the same, thus: acetic acid, 232/1·16 = 200; naphthalene, 219/1·06 = 206; chlorobenzene, 180/0·92 = 194. H. C.

Influence of Chemical Constitution of Organic Compounds on their capability of forming Solid Solutions. By Felice Garelli (*Zeit. physikal. Chem.*, 1895, **18**, 51—60).—The paper contains further examples of abnormal depressions of the freezing point occurring when solvent and dissolved substance are closely allied in constitution. Cumarone, indole, and indene in naphthalene give too high values for the molecular weight, as do diphenylene oxide and β-naphthoquinoline in phenanthrene, phenanthroline in the same solvent giving a normal result. Dithienyl gives an abnormal depression in diphenyl, but normal in benzene, whilst metanicotine gives a normal value in diphenyl, a result in accord with the views of Pinner (Abstr., 1894, i, 388; 1895, i, 116). The regularity observed in the cyclic compounds is markedly modified by the presence of side chains, thus methylpyrroline gives a normal depression in benzene, as do pyrroline and thiophen in paraxylene, whilst αα-dimethylpyrroline and αα-dimethylthiophen give abnormal values in paraxylene. In acetophenone, acetylpyrroline and acetothienone give, as expected, abnormal depressions. In benzoic acid as solvent, α-pyrrolinecarboxylic acid, α-thiophencarboxylic acid, ortho- and meta-hydroxybenzoic acids, and orthamidobenzoic acid give abnormal depressions, whilst those caused by parahydroxybenzoic and furfurancarboxylic acids are normal, those due to meta- and para-amidobenzoic acids being nearly so. In phenol, the three dihydroxybenzenes are slightly abnormal, whilst in resorcinol the ortho- and para-compounds give normal values. Some fatty compounds are also examined: maleic anhydride in succinic anhydride giving an abnormal result, whilst those of oleïc acid in stearic acid, butyric acid in crotonic acid, apiole and dihydro-apiole in isapiole are normal. In a short note on Beckmann's work (Abstr., 1895, ii, 383), the author does not consider that the abnormal results of iodine in benzene solution can be due to the formation of a solid solution.

L. M. J.

The Velocity Law of Polymolecular Reactions. By ARTHUR A. NOYES (and WALTER O. SCOTT) (*Zeit. physikal. Chem.*, 1895, **18**, 118—132).—For the determination of the order of a chemical reaction, the constancy of the velocity constant is not alone sufficient, but comparison should be made of the constants, at a definite stage of the action, obtained in independent experiments with different initial concentrations. Examined thus, it is seen that the action between hydrogen iodide and hydrogen peroxide is of the second order (see Magnanini, Abstr., 1892, 110), whilst the same holds for the action between hydrogen iodide and bromic acid. According to Schwicker's experiments (Abstr., 1895, ii, 213), the decomposition of potassium hypoiodite is, if in the presence of free iodine, of the first order, but no definite conclusion can be drawn if alkali is in excess. The reaction between ferric and stannous chlorides is, however, of the third order, as is the polymerisation of cyanic acid. An explanation of the first three cases, may be that the reaction takes place in two or more stages, of which the first alone takes an appreciable time. For example, $HI + H_2O_2 = HIO + H_2O$; $HIO + HI = H_2O + I_2$. In the last two cases, van't Hoff's law, that the order is determined by the number of interacting molecules, is obeyed. L. M. J.

A Reversible Reaction of the First Order. By FRITZ W. KÜSTER (*Zeit. physikal. Chem.*, 1895, **18**, 161—179).—The reversible change of hexachlor-α-keto-β-pentene $\rightleftarrows$ hexachlor-α-keto-γ-pentene is considered. The estimation of the compounds is effected readily, owing to the slight solubility of the anilide of the β-compound. The β-compound was heated at 210°, and the quantity of the γ-compound estimated hourly, the final state being reached when the quantity was 0·386, whilst the value of $1/t \log 1/(1 + c'/c)x$ varied from 0·055 to 0·035. The change from the γ-compound to the β- was examined at the same temperature, the final stage being reached when 0·613 of the β-compound was formed, a number agreeing exactly with the previous results. Experiments in different atmospheres showed that small quantities of aqueous vapour have a high accelerative influence, the same obtaining to a smaller extent for hydrogen chloride. An increase in temperature to 237·5° caused the velocity to increase tenfold, but the final ratio was only slightly altered, 0·63 to 0·65. At 300°, equilibrium was very speedily reached, the final ratio being 0·85.

L. M. J.

Velocity of the Hydrolysis of Salicin by Acids. By ARTHUR A. NOYES and WILLIAM J. HALL (*Zeit. physikal. Chem.*, 1895, **18**, 240—244).—The investigations were undertaken to determine whether the hydrolysis of a glucoside is in accordance with the reaction law which obtains for the inversion of cane sugar, &c. Salicin was employed for the purpose, the formation of either saligenin or saliretin during the reaction being immaterial, as both are inactive. A 5 per cent. solution was first employed, the rotation of which was $-12·32°$, and when completely hydrolysed $+6·00°$, the ratio being hence $0·487 = c$. If the reaction takes place according to the equation $dx/dt = k(A - x)$, the value for the constant k is given by $1/t \log \{(ca_0 + a_1)/(ca_0 + a)\}$, where a_0 is the initial rotation, a_1 that at the arbitrary zero of time, and a that after time t. The values thus obtained for k are in close accord, the greatest variation being about 8 per cent., and the reaction therefore, like the sugar inversion, is of the first order. The relative effects of the acids follow the same order as their effects in sugar inversion, as is seen in the following table.

N/5 acid.	Salicin hydrolysis.	Sugar inversion.
Hydrochloric	1000	1000
Sulphuric	499	536
Oxalic	223	186
Malonic	45	31

L. M. J.

Molecular Symmetry and Asymmetry. By PAUL GROTH (*Ber.*, 1895, **28**, 2510—2511).—The generally accepted statement, contradicted by Ladenburg (Abstr., 1895, ii, 489), that when the molecule of a substance contains no plane of symmetry, the substance exhibits enantiomorphism, is quite correct, for planes of symmetry are of two kinds, namely, simple and compound. A figure possesses a plane of simple or direct symmetry when it gives a superposable image on reflection from that plane, whilst it possesses a plane of compound or indirect symmetry when a superposable image is only obtained after reflection and rotation through 180° about the normal to the plane. Diketopiperazine, the example quoted by Ladenburg, possesses a plane of compound symmetry, and, therefore, cannot exhibit enantiomorphism; the application of the term pseudosymmetry to such a case is undesirable, this term being already used in another way.

The author points out that the whole question of the symmetry of geometrical figures is now worked out in crystallographic text-books in such a way as to be immediately applicable to all problems concerning molecular symmetry. W. J. P.

Size of Crystalline Molecules. By ANDREAS FOCK (*Ber.*, 1895, **28**, 2734—2742).—Nernst has shown (Abstr., 1892, 560) that when an aqueous solution, containing c_1 and c_2 molecules of two isomorphous salts per unit volume, is in equilibrium with a solid solution composed of x_1 and x_2 molecules per cent. of the same two salts respectively, the ratios c_1/x_1 and c_2/x_2 are constant for all concentrations if the molecular weights of the two salts are the same in both the liquid and the solid solutions; if, however, the molecular weight in the solid state is n times that in the liquid state, n being greater or less than unity, then c_1^n/x_1 and c_2^n/x_2 are constant. If ionic dissociation occurs, the number of molecules in the liquid solution changes, and this alteration must be allowed for in using the above constants; but inasmuch as the extent of the electrolytic dissociation of two salts having a common ion, in aqueous solution, is the same, the above ratio should remain practically constant when the solubility of the two salts in molecules per unit volume is nearly the same; if the dissociation is slight, it can of course also be disregarded.

Disregarding dissociation, therefore, the author has calculated the values of the above ratios taking the pairs of isomorphous salts investigated by Muthmann and Kuntze (Abstr., 1895, ii, 7) and shows that potassium dihydrogen phosphate and arsenate have the same molecular weight both in solution and in the crystalline state. Potassium permanganate and perchlorate and rubidium permanganate have, however, twice the molecular weight when solid that they have when liquid.

The author contends that Muthmann and Kuntze's numbers for the equilibrium between potassium and rubidium permanganates and their aqueous solution show that the two salts crystallise together in all proportions, and not between very narrow limits as stated in the paper quoted above. W. J. P.

Running together and Healing of Crystals. By OTHO LEHMANN (*Zeit. physikal. Chem.*, 1895, **18**, 91—96).—On warming potassium oleate, or even ordinary soap, on a microscope slide with insufficient alcohol for its complete solution, and allowing the slide to cool, pointed tetragonal octahedra separate; these crystals are 0·1—0·3 mm. in length and each usually consists of a string of several individual crystals; they are best observed by using alcohol coloured red by some dye which is not taken up by the deposited crystals. When, by moving the cover-slip two of these crystals are so brought into contact that their long diameters become perpendicular, or in approximately the position of twinning, the sharp end of the one crystal merely flattens itself against the mass of the other; if, however, by manipulating the cover slip, the crystals be moved until their longer axes are at about 60°, the smaller crystal turns of its own accord until in a parallel position to the larger one, and then the two crystals so join together as to form one homogeneous whole. The tendency which deformed soft crystals, such as these, have, towards again assuming a regular form, may be also observed by crushing one of the larger crystals of potassium oleate into small detached fragments by pressure on the cover slip; the small fragments soon become of quite symmetrical form.

The processes involved in these changes are obviously the same as those by which a broken crystal becomes whole, or heals itself when immersed in its crystallising solution; in the latter case, the surface tension of the solid mass can only act through the agency of the solution, whilst with soft crystals like the above, the surface tension of the solid is sufficiently powerful to cause the arrangement of the fragments in parallel orientation. W. J. P.

Convenient Forms of Laboratory Apparatus. By D. ALBERT KREIDER (*Amer. J. Sci.*, 1895, [3], **50**, 132—134).—The author describes a simple form of *hot filter.* The jacket consists of an inverted flask, the bottom of which has been removed, the top of the funnel fits into this opening, and the neck is closed by a stopper containing perforations for the stem of the funnel, and for the steam and waste pipes. An improved form of the ordinary *Bunsen valve* is also described. It consists of a stout glass tube sealed at one end and drawn out in the middle with an opening in the constriction, a piece of rubber tubing containing a smooth slit is placed over this. The collapse of the rubber, which is so common in the Bunsen valve, is thus rendered impossible. The valve works much better when lubricated with glycerol. A convenient *force pump* may be constructed by adjusting two of the valves just described to the opposite extremities of a T-tube, whilst the third limb is enlarged so as to permit the attachment of a large and stout piece of rubber tubing closed at one end; this tube being alternately compressed and released by the hand. J. J. S.

A New Refractometer. By CARL PULFRICH (*Zeit. physikal. Chem.*, 1895, **18**, 294—299.—The author has devised some improvements on the older form of his well-known refractometer so that the instrument is now available for the determination of the refractive index and dispersion not only for sodium light, but also for the C, F, and G lines. A heating arrangement is also added for the investigation of liquids at various temperatures, and of compounds which have high melting points, whilst the new instrument is also adapted for use as a differential refractometer—that is for the direct determination of the refractive index or dispersion of one solid or liquid with respect to a second. L. M. J.

Inorganic Chemistry.

Possibility of the Occurrence of Hydrogen and of Methane in the Atmosphere. By Francis C. Phillips (*J. Amer. Chem. Soc.*, 1895, **17**, 801—809).—Since hydrogen and methane are largely evolved during the decay of organic matter under water, and since, by the gradual erosion of rocks, quantities of natural gas are being constantly liberated, the author thinks it is quite probable that both these gases may exist in the atmosphere. Experiments made at Mount Washington, New Hampshire (7,000 ft. above sea level) gave negative results, but it is suggested that experiments should be made at much greater altitudes, as, since hydrogen and methane are both very light, they would tend to form a zone resting on the heavier gases of the atmosphere.

The author recommends the use of anhydrous palladium chloride for the detection of traces of hydrogen in a mixture of gases. Free hydrogen reduces this salt in the cold, forming hydrogen chloride, which can be tested for by means of silver nitrate. J. J. S.

Combination of Hydrogen with Oxygen. By Victor Meyer and Wilhelm Raum (*Ber.*, 1895, **28**, 2804—2807).—When heated in sealed bulbs for 10 days, at 300°, hydrogen and oxygen do not appear to combine at all, but when the heating is continued at the same temperature for 65 days (300—305°) the amounts of water formed in three bulbs were 9·5 per cent., 0·4 per cent., and 1·3 per cent. When heated at 100° even for 218 days and nights, no water appears to be formed. The authors consider that these experiments confirm the theoretical view that combination actually takes place between hydrogen and oxygen at the ordinary temperature, but at so slow a rate that no appreciable amount of water is formed during a measurable period. A. H.

Hydrogen Peroxide. By Julius W. Brühl (*Ber.*, 1895, **28**, 2847—2866).—A detailed historical account of the discovery and investigation of hydrogen peroxide is given. The specimens employed were prepared by distilling under diminished pressure the commercial article after the addition, if necessary, of a little barium hydroxide to remove silicic acid and salts of the heavy metals; the purest preparation boiled at 69·2° (26 mm.). The stability increases with the concentration, specimens containing 95—100 per cent. H_2O_2 are scarcely changed after 5—7 weeks, if direct sunlight is excluded, the surface reduced as much as possible, and the containing vessel kept smooth; prolonged shaking favours decomposition, and the compound cannot be conveniently transported by train. Guncotton is the best medium for the filtration of hydrogen peroxide, asbestos causes rapid decomposition, and wool readily ignites. Surface action is entirely excluded if the vessel is coated with paraffin; the optical constants given below were determined with prisms treated in this manner, as ground glass causes immediate decomposition of the hydrogen peroxide.

If the hydrogen peroxide is isolated by the help of ether, great care is required during the distillation; on one occasion, a specimen prepared in this manner smelt strongly of ozone, an oily substance remained which did not volatilise at 100°, had no smell, and detonated feebly when a drop was placed on platinum in a flame, but the introduction into it of a sharp-edged, glass rod caused a violent and disastrous explosion.

The sp. gr. is 1·4584 at 0°/4°, and 1·4378 at 20°/4°. Four series of determinations of the optical constants were made, of which the following values, for the molecular refraction and dispersion, are regarded as the most accurate. $\mathfrak{M}_a = 5{\cdot}791$; $\mathfrak{M}_{Na} = 5{\cdot}817$; $\mathfrak{M}_\gamma - \mathfrak{M}_a = 0{\cdot}136$, the calculated values for the formula $\mathrm{HO{\cdot}OH} = 5{\cdot}18$, 5·32, and 0·10 respectively. The corresponding values for oxygen are as follows.

	$\mathfrak{M}_a$.	$\mathfrak{M}_{Na}$.	$\mathfrak{M}_\gamma - \mathfrak{M}_a$.
Oxygen in water (2O)........	2·968	3·212	0·036
,, hydrogen peroxide..	3·591	3·717	0·055
,, molecular O_2, liquid.	3·958	3·964	0·069
,, ,, gaseous	—	4·09	—

This increase in the values of molecular oxygen probably denotes the presence in it of one or more double linkings, and, from its analogy to sulphur, oxygen is probably quadrivalent. In support of this view, the compounds Ag_4O and $HClOMe_2$ are cited; the latter is known both as gas and liquid; the formation of hydrogen peroxide from nascent hydrogen and molecular oxygen, its decomposition by means of nascent oxygen, and its resolution into water and molecular oxygen are also mentioned. Reference is made to the optical constants of carbonic oxide, which have been shown by the author to be higher than those calculated from the formula $\mathrm{C{:}O}$; this compound he regards as $\mathrm{C}\vdots\mathrm{O}$, all other organic oxygen compounds being "unsaturated" in the same sense as bivalent sulphur derivatives, and compounds of trivalent phosphorus and nitrogen (compare Tafel, Abstr., 1894, ii, 448). J. B. T.

Constitution of Water and the Cause of its Dissociating Power. By JULIUS W. BRÜHL (*Ber.*, 1895, **28**, 2866—2868; and *Zeit. physikal. Chem.*, 1895, **18**, 514—518).—Assuming the quadrivalency of oxygen (compare preceding abstract), water must be an unsaturated compound; to this cause is referred its great dissociating power both for molecular aggregates and single molecules, its readiness in combining with other substances, and the ease with which it forms molecular aggregates. The fact that most substances are more or less hygroscopic and soluble in water is cited in further proof. The organic compounds which most closely resemble water in these properties, such as the alcohols, ketones, ethereal salts, acids, &c., also contain oxygen, and their dissociating power generally decreases as the molecular weight rises and the content of oxygen falls. The hydrocarbons and their haloïd substitution products have little or no dissociating power. J. B. T.

Separation of Tellurium from Copper Residues. By CABELL WHITEHEAD (*J. Amer. Chem. Soc.*, 1895, **17**, 849—855).—All copper produced from American sulphide ores contains tellurium. A method for the estimation of this tellurium has already been given (Abstr., 1895, ii, 289). In the electrical refining of copper, the washings from the gold residues contain the tellurium as tellurous oxide or sulphate. The tellurium may be obtained from these either by precipitation with copper or by passing sulphurous anhydride through the solution. It may be finally purified by distillation in hydrogen.

When a solution of sodium tellurite is added to a solution of an ammonium salt, a white precipitate of tellurous anhydride is thrown down, which becomes granular on boiling. A small amount of tellurium or of some metal which can be precipitated by sulphurous anhydride remains in solution; this soluble portion is still under investigation. Potassium ferrocyanide does not react with tellurium chloride at once, but, after a few hours, Prussian blue is formed.

When tellurium is heated with aluminium, the two combine with explosive violence, forming a chocolate coloured, difficultly fusible compound, which has the composition Al_2Te_3. It is hard and brittle, and can readily be ground to powder; when exposed to moist air, it is decomposed, and hydrogen telluride is slowly evolved; when thrown into water, it is rapidly decomposed.

Tellurium is readily deposited by an electric current either from an acid or alkaline solution. It has been found possible to separate tellurium from copper by adding an excess of sodium hydroxide and about 3 grams of potassium cyanide for each gram of copper present, and passing an electric current through the solution; when the tellurium is thrown down as a black, non-adherent precipitate, which can readily be filtered off; the solution can then be slightly acidified with sulphuric acid and the copper estimated in the usual way by electrolysis. J. J. S.

Action of Gaseous Hydrogen Chloride on Salts of the Elements of the Fifth Group of the Periodic System. By EDGAR F. SMITH and JOSEPH G. HIBBS (*J. Amer. Chem. Soc.*, 1895, **17**, 682—686).—The authors find that sodium nitrate, when heated in a current of hydrogen chloride, is completely converted into sodium chloride. Phosphates are not decomposed, in so far that no phosphorus chloride is given off; but arsenates of sodium, magnesium, and lead are completely converted into chlorides, whilst the arsenic is entirely volatilised (as chloride or ? oxychloride), and may be collected in a bulb apparatus filled with water. When acting on sodium vanadate, the vanadium is expelled as oxychloride. L. DE K.

Action of Gaseous Halogen acids on the Salts of the Elements of the Fifth Group of the Periodic System. By EDGAR F. SMITH and FRED L. MEYER (*J. Amer. Chem. Soc.*, 1895, **17**, 735—739).—Sodium nitrate is completely converted into the corresponding fluoride by the action of hydrogen fluoride at 250°. Phosphates are not attacked. Vanadates are but partially decomposed, and even at a high temperature only about one-half of the vanadium is expelled. The same result was obtained with arsenates.

When working with hydrogen bromide, it is found that sodium nitrate is completely converted into the corresponding bromide. Phosphates are not acted on. Sodium vanadate is strongly, but not completely, attacked with formation of vanadium oxybromide. Arsenates are completely decomposed, all the arsenic being volatilised as bromide.

Using hydrogen iodide, the experiment with sodium nitrate could not be brought to a satisfactory conclusion, owing to the formation of some explosive bye-products. Phosphates are not acted on. Arsenates are, no doubt, completely decomposed, but exact proof is wanting, as explosive compounds are also formed and interfere with a correct analysis.

The action of the gaseous halogen acids on antimony, columbium, and tantalum is also mentioned, but no analytical details are given.

L. DE K.

Data for the Ascertainment of the True Atomic Weight of Carbon. By J. ALFRED WANKLYN (*Chem. News*, 1895, **72**, 164—165).—Arguments are adduced in favour of a reversion to 6 for the atomic weight of carbon (compare this vol., i, 1, 2). Reasons are also assigned for doubting whether Schorlemmer's hydride of heptyl (this Journal, 1863, 216) was not a mixture of hydrocarbons.

D. A. L.

Varieties of Graphite. By HENRI MOISSAN (*Compt. rend.*, 1895, **121**, 540—542).—The author has examined specimens of graphite from various localities, mainly with a view of ascertaining which are intumescent, like the graphite obtained by dissolving carbon in metals at very high temperatures, and which are non-intumescent, like the graphite produced by the effect of a high temperature alone on any other form of carbon. *Ceylon*, intumescent; after purification by treatment with fused potash and with hydrofluoric acid, it contains no form of carbon but graphite. *Ticonderoga*, intumescent. *Greenville*, intumescent. *Borrowdale*, non-intumescent, but decrepitates when heated, and gives off about four times its own volume of gas, consisting mainly of hydrocarbons and hydrogen mixed with some air. *Omesnack* (Greenland), crystalline, but non-intumescent. *Mugrau* (Bohemia), and *Scharzbach* (Bohemia), also crystalline but non-intumescent. *Australia*, non-crystalline and non-intumescent.

C. H. B.

Helium and its Place in the Natural Classification of Elementary Substances. By HENRY WILDE (*Phil. Mag.*, 1895, [5], **40**, 466—471).—The author has examined the spectrum of helium obtained by the distillation method from Norwegian clèveite, pitchblende, and other minerals containing uranium, more especially some heavy, zirconiferous sand, containing uranium, which is found in large deposits on the coast of Brazil, and which is a relatively abundant source of helium. The result of these experiments confirms the author's previous conclusion, that the differences in the determinations by different observers of the wave-lengths of the components of the characteristic yellow line, are due to the influence of pressure and diffusion with other gases in varying the width of spectral lines on the more refrangible side of the spectrum. This shows that, within certain limits, the distance between the components of D_3 is not to be taken as the criterion of the identity of chromospheric and terrestrial helium.

In the author's classification of elementary substances in multiple proportions of their atomic weights, each series or family is considered to be condensations of the typical elements $H, H_2, H_3, H_4, H_5, H_6, H_7$ (*Chem. News*, **38**, 66, 96, 107). The properties of helium indicate that it is the typical element H_3 at the head of the uneven series H_{3n}.

H. C.

Estimation of Argon. By TH. SCHLŒSING, jun. (*Compt. rend.*, 1895, **121**, 604—606).—Further experiments have shown that the error in the estimation of argon by the author's method (this vol., ii, 219) amounts to about 0·7 per cent. of the argon to be estimated, and is not due to any action of the steel, porcelain, asbestos, copper, or cupric oxide on the argon. When the magnesium is not heated, the loss is about 0·25 per cent., and when it is heated, the loss is from 0·5 to 1·0 per cent., and increases with the duration of the experiment and the pressure of the argon in the apparatus.

The following estimations were made with the air of Paris collected 10 metres above the soil.

	Sep. 25.	Sep. 26.	Sep. 30.	Oct. 1.	Oct. 4.	Mean.
Per 100 vols. of air	0·9369	0·9349	0·9367	0·9325	0·9363	0·935
Per 100 vols. of nitrogen	1·185	1·183	1·185	1·180	1·185	1·184

Other estimations were as follows.

	Per 100 vols. of air.	Per 100 vols. of nitrogen.
Air in Normandy at a height of 305 metres..	0·9343	1·182
Air round the Eiffel Tower at a height of 300 metres........................	0·9328	1·180
Air in the gallery of an iron mine.........	0·9354	1·183
	0·934	1·182

The differences are of the same order as the errors of experiment, and it would seem that the proportion of argon in the atmosphere is as constant as that of oxygen or nitrogen. Making the correction of 0·7 per cent. as above, the numbers for normal air become 0·941 and 1·192. Calculation of the difference in density between pure nitrogen and atmospheric nitrogen mixed with argon gives 0·0063, whilst Rayleigh and Ramsay found 0·0067.

The following estimations were made in the gas drawn from various soils.

	Argon per 100 vols. of nitrogen.
At a depth of 0·20 mm. in the soil of a pine wood ...	1·170
,, ,, 0·40 ,, ,, of an arable field..	1·169
,, ,, 0·40 ,, ,, of an arable field..	1·155
,, ,, 0·40 ,, very light garden soil....	1·118

The lower proportion of argon is probably due to the fact that it is considerably more soluble in water than nitrogen is. C. H. B.

Solubility of Silver Halogen Salts in various Solvents. By ERNST COHEN (*Zeit. physikal. Chem.*, 1895, **18**, 61—69).—The experiments of Valenta (Abstr., 1894, ii, 418) on the solubility of the silver salts of halogen acids in sodium thiosulphate and in potassium cyanide, indicate that the solubility is not that deducible from the equations (I) $3Na_2S_2O_3 + 2AgCl = (AgS_2O_3Na)_2,Na_2S_2O_3 + 2NaCl$ and (II) $2KCN + AgCl = KAg(CN)_2 + KCl$. The author has, therefore, examined these solubility phenomena with the following results. (1) Silver chloride, if not in excess, dissolves in sodium thiosulphate in accordance with equation I. (2) If the silver chloride is in excess, the less soluble salt, $(AgS_2O_3Na)_2$, is formed. (3) If not in excess, silver chloride dissolves in potassium cyanide solution in accordance with equation II. (4) Excess of the silver salt causes the double salt to be partly decomposed, with formation of silver cyanide and potassium which can react in the reverse sense until equilibrium is reached, $KAg(CN)_2 + AgCl \rightleftarrows 2AgCN + KCl$. Valenta's results were due to the fact that he operated with a large excess of the silver haloïd L. M. J.

Preparation of Lime and Strontia Crystals. By G. BRÜGELMANN (*Zeit. anorg. Chem.*, 1895, **10**, 415—433).—The author has already shown that the alkaline earths can be obtained in crystals by melting and decomposing their nitrates by means of heat. The conditions necessary for the formation of good crystals are that the crucible be heated to the necessary temperature only on one side; that perfectly dry calcium nitrate be employed, and that the crucible be tightly covered during the decomposition so that the air and furnace gases are excluded. Crystals of lime, measuring 1·6 cm., and of strontia, 5·5 mm. in length, have been obtained. A complete description, with drawings, of the furnaces employed, is given in the original paper. The lime crystals are prepared in porcelain crucibles, the strontia crystals in platinum crucibles. The crystals must be carefully preserved in air-tight vessels, dried with pieces of lime and strontia. On exposure to air, they turn dull, but may be brought to their former brightness by heating with dry lime or strontia.

E. C. R.

Normal Calcium Chromite. By E. DUFAU (*Compt. rend.*, 1895, **121**, 689—691).—A mixture of 115 grams of chromic oxide and 45 grams of calcium oxide was heated in the electric furnace with a current of 700 ampères and 50 volts. The product is a mixture of yellow lamellæ, similar to those obtained by Moissan by heating chromium and calcium oxides in the electric arc, and green, acicular crystals, which are found in the hottest parts of the furnace, and are, therefore, stable at high temperatures. The product is heated with boiling, concentrated, hydrochloric acid until nothing more dissolves. The residue consists of lustrous green, prismatic needles of the normal chromite, CaO,Cr_2O_3; sp. gr. = 4·8 at 18°; hardness about 6°. The crystals are not attacked by fluorine in the cold, but on gently heating an energetic action takes place with incandescence. Chlorine attacks the chromite slowly at a bright red heat, but bromine, iodine, and sulphur are without action at the softening point of glass, and water vapour has no effect at a bright red heat. At the softening point of glass, the chromite burns brilliantly in oxygen, with formation of calcium chromate and chromic oxide. Hydrofluoric and hydrochloric acids and concentrated nitric and sulphuric acids have no action on the chromite, but dry, gaseous hydrogen fluoride and hydrogen chloride decompose it at a red heat. Fused potassium nitrate or chlorate or hydroxide, or fused alkali carbonates readily attack the chromite.

In composition, the chromite is identical with that obtained by Gerber by heating calcium chloride with potassium dichromate.

C. H. B.

Preparation of Pure Beryllium Oxide from Emerald. By Paul Lebeau (*Compt. rend.*, 1895, **121**, 641—643).—The emerald is first fused with twice its weight of calcium fluoride in a plumbago crucible by means of a coke fire, and the fused mass is poured into water. A friable product is thus obtained which is very energetically attacked by sulphuric acid, even in the cold. When evolution of silicon fluoride ceases, the residue is strongly heated until sulphuric anhydride is given off freely, and then thrown into water in small quantities at a time. The clear liquid is decanted, concentrated, partially neutralised with potassium carbonate, and allowed to cool, when the greater part of the aluminium separates as alum. An impure beryllium ammonium carbonate is obtained from the mother liquor by treating it with ammonia and ammonium carbonate.

Another plan is to heat the emerald in a carbon tube in the electric furnace; a large quantity of silica is volatilised, and the residue, which contains only about 30 per cent. of silica, breaks up into powder as it cools. This basic silicate is decomposed by acids, and is treated with a mixture of hydrofluoric and sulphuric acids.

The impure beryllium ammonium carbonate is dissolved in nitric acid, the iron precipitated by a small quantity of potassium ferrocyanide, the excess of ferrocyanide removed by means of copper nitrate, and the excess of copper by hydrogen sulphide. The solution is then mixed with ammonia, and the precipitate allowed to remain in the liquid for three or four days, so that the alumina may polymerise and become insoluble in ammonium carbonate. The liquid is then decanted, and the precipitate treated with a concentrated solution of ammonium carbonate which slowly dissolves the beryllia. The filtered solution is boiled, and the well washed precipitate is dissolved in nitric acid, the solution evaporated to dryness, and the residue strongly heated. The beryllia thus obtained shows the spectra of no other metals.

C. H. B.

Purification of Beryllium Salts. By Edward Hart (*J. Amer. Chem. Soc.*, 1895, **17**, 604—605).—The process depends on the fact that on adding sodium carbonate to an impure solution of beryllium sulphate, any iron and aluminium are precipitated first.

The powdered beryl is fused with potassium-sodium carbonate, ground and washed with water, mixed with sulphuric acid, and evaporated to render the silica insoluble. The bulk of the aluminium is then removed as alum by adding potassium sulphate, and, after oxidising any iron with potassium chlorate, it is, together with the remaining aluminium, precipitated by the cautious addition of sodium carbonate. After filtering, the beryllium is precipitated as carbonate. L. DE K.

Beryllium Carbide. By PAUL LEBEAU (*Compt. rend.*, 1895, **121**, 496—499).—Pure beryllium oxide was intimately mixed with half its weight of sugar-carbon and a small quantity of oil, and heated in the electric tube furnace for eight to ten minutes with a current of 950 ampères and 40 volts. Less powerful currents yield a nitride or products containing nitrogen and carbon.

The beryllium carbide obtained under these conditions forms transparent, yellow-brown, microscopic crystals, similar to those of aluminium carbide, which it also resembles in chemical properties. The crystals scratch quartz easily; sp. gr. = 1·9 at 15°.

The carbide is readily attacked by chlorine at a dull red heat, with formation of beryllium chloride and a residue of amorphous carbon and graphite. Bromine behaves similarly at a somewhat higher temperature, but iodine has no action even at 800°. Oxygen produces superficial oxidation at a dull red heat, sulphur vapour attacks it below 1000°, but phosphorus and nitrogen have no appreciable action at dull redness. Dry hydrogen fluoride attacks the carbide with incandescence below a red heat, with formation of fluoride and liberation of carbon; hydrogen chloride behaves similarly, but with less energy. In contact with water or dilute acids, the carbide is slowly decomposed, with liberation of methane; the change occurring rapidly and completely in contact with a hot concentrated sodium or potassium hydroxide solution. It reduces concentrated boiling sulphuric acid, but is only slowly attacked by concentrated nitric or hydrochloric acids, although hot hydrofluoric acid dissolves it rapidly. Fused potassium hydroxide decomposes it with incandescence, potassium nitrate and chlorate are without action, but potassium permanganate and lead peroxide oxidise it readily.

The carbide has the composition Be_4C_3 (Be = 13·8), and no other carbide seems to exist. C. H. B.

Beryllium Carbide. By LOUIS HENRY (*Compt. rend.*, 1895, **121**, 600—601).—It does not follow that because the beryllium carbide described by Lebeau (preceding abstract) is generally similar in its properties to aluminium carbide, it must be analogous in composition. Magnesia and silica are both in many respects similar to alumina. The analyses of the carbide quoted by Lebeau agree closely with the formula CBe_2, and the apparent analogy between this compound and aluminium carbide cannot be allowed to over-ride the great weight of the other experimental evidence in fixing the valency of beryllium. C. H. B.

Constitution of Metallic Bases. By Nicolai Kurnakoff (*J. pr. Chem.*, 1895, [2], **52**, 490—528).—In continuation of his previous paper (Abstr., 1895, i, 499), the author treats of the compounds in which ammonia replaces water of crystallisation, either wholly or in part, and reviews the theories which have been advanced in explanation of the existence of metallic ammonia salts of the general form MX_m,nNH_3. These theories fall into three classes—(1) the ammonium theory, depending on the pentad nature of nitrogen; (2) the theory which regards the haloïd or other acid radicle in the metallic salt as unsaturated; (3) the theory of higher types of metallic compounds as expounded by Mendeléeff. In connection with the last, the author quotes some results which he has obtained while investigating the refraction coefficient of solutions of the compounds $PtCl_2,4NH_3$, K_2PtCl_4, Na_2PtCl_6, and $PtCl_2(NO_3)_2,4NH_3$. None of the theories to which reference is made can, in the author's opinion, be regarded as furnishing the basis for a generalisation as to the constitution of the metallic bases, although each serves to throw light on the subject. A. G. B

Mechanical Properties of Alloys of Copper and Zinc. By Georges Charpy (*Compt. rend.*, 1895, **121**, 494—496).—Alloys of copper and zinc, containing from 0 to 50 per cent. of the latter, were rolled and hammered in the cold until they were brought to a condition of maximum brittleness, and broke with practically no deformation. They were then annealed at various temperatures and subjected to tension and compression. For the crude cast alloys, the resistance depends on the temperature of casting and on the rate of cooling; it increases when the metal is cast near its melting point, and when the mould is arranged so as to produce rapid solidification.

The temperatures of annealing may be divided into four zones, which vary with the composition of the alloy. The first, or zone of *no annealing*, extends to about 350° for red copper, but the maximum limit falls as the proportion of zinc increases. The second, or zone of *variable annealing*, in which the degree of annealing varies continuously with the temperature, is almost unrecognisable for copper, but its range increases with the proportion of zinc, and for an alloy containing 40 per cent. of zinc it extends almost from the ordinary temperature up to the melting point. In the third, or zone of *constant annealing*, the effect on the mechanical properties is practically constant; the zone extends from about 400° to 1,000° for copper, but diminishes as the proportion of zinc increases. In all three zones, annealing lowers the resistance and increases the extension before breaking.

The fourth zone comprises high temperatures near the melting points, and in these the metal undergoes deterioration or is "burnt," and both the resistance and the extension are reduced. The range of this zone seems to depend on the proportion of impurities present.

The resistance to tension increases with the proportion of zinc up to about 43 per cent., and then falls rapidly; the elongation before breaking also increases with the proportion of zinc up to about 30 per cent., and then falls rapidly. The most useful alloys are those which contain from 30 to 43 per cent. of zinc; a high proportion of zinc corresponds to a higher resistance, and a high proportion of copper to a greater elongation before breaking. C. H. B.

Oxidation of some Gases with Palladinised Copper Oxide. By Edward D. Campbell (*Amer. Chem. J.*, 1895, **17**, 681—692).—The palladinised copper oxide was prepared as follows:—(1) Copper was alloyed with palladium (1 per cent.), care being taken to cool the molten mass as quickly as possible; the alloy was then annealed, divided into small pieces, and oxidised in the tube. In the determinations given below, this oxide was employed. (2) Finely divided oxide, prepared by the preceding method, was mixed with gum, pressed into wire, and ignited. (3) Palladium (3 grams) was dissolved in aqua regia, and the solution, after removal of the excess of acid, mixed with finely divided copper oxide (300 grams); the stiff paste was dried at 120°, finely ground, mixed with gum, pressed into wire, and ignited. The temperatures given below are the initial combustion temperatures when the palladinised copper oxide is employed, those in brackets are the values obtained with pure copper oxide. Hydrogen 80—85° (175—180°), carbon monoxide 100—105° (100—105°), ethylene 240—250° (315—325°), propylene 220—230° (270—280°), isobutylene 270—280° (320—330°), methane no combustion at 455°. Acetylene, unlike the preceding gases, does not burn directly; at 395—400°, only $\frac{2}{3}$ of the carbon and $\frac{8}{9}$ of the hydrogen are oxidised, the remainder forms a black deposit in the tube. Full details are given of the apparatus employed, and the quantity of the various gases burnt per hour at different temperatures is also tabulated. J. B. T.

Action of Hydrochloric acid on Copper. By Rodolphe Engel (*Compt. rend.*, 1895, **121**, 528—530).—Hydrochloric acid saturated at 15° attacks copper somewhat rapidly with evolution of hydrogen, and the evolution of gas becomes tumultuous if the copper is previously immersed in a dilute solution of platinum chloride. No action takes place with a solution of a sp. gr. so low as 1·083, which corresponds with the composition $HCl + 10H_2O$. When the liquid is saturated with cuprous chloride, the action becomes very slow, even though the quantity of free acid present may considerably exceed the minimum limit just specified. Similar phenomena are observed with zinc and tin. A rise of temperature increases the action, and *vice versâ*, doubtless in consequence of the variations in the solubility of the cuprous chloride. At the ordinary temperature, equilibrium is only established after a very long period.

When gaseous hydrogen chloride is passed into water containing copper and cuprous chloride, the acid is rapidly decomposed, notwithstanding the presence of the copper salt, and it follows that anhydrous hydrogen chloride is always decomposed by copper.

C. H. B.

Action of Nitric Oxide on certain Salts. By H. A. AUDEN and GILBERT J. FOWLER (*Chem. News*, 1895, **72**, 163).—The substances were exposed in a stream of nitric oxide at the ordinary temperature and at gradually increasing temperatures, and were weighed at intervals of temperature.

Lead dioxide, and also manganese dioxide, yields basic nitrate with but a trace of nitrite; with lead oxide, the action commences at 15° and reaches a maximum at 130°; with manganese oxide, the action is not so rapid, and is at its highest at 216°.

Moist silver oxide yields equivalent parts of nitrite and free metal at the ordinary temperature, whilst at higher temperatures the dry oxide yields silver and silver nitrate. Silver permanganate is attacked at the ordinary temperature, but at 80° the action is very sharp; the products being silver, silver oxide and nitrate, manganese dioxide, with little or no manganese nitrate. Potassium permanganate is not appreciably attacked below 100°, but vigorously at 190°, yielding potassium nitrate and manganese oxide.

Potassium chlorate, and also barium chlorate, yield chlorine and nitrogen peroxide at the ordinary temperature; the percentage of chlorine in the gaseous product being below that required to form nitrosyl or nitroxyl chloride; the solid product is the nitrate, with a trace of perchlorate, but no chloride. Silver chlorate also yields chlorine in abundance, but at the same time a large proportion of silver chloride is formed. Potassium iodate commences to evolve iodine at 80°, and at 110° the evolution is rapid; nitrate without iodide remains. Silver iodate, on the other hand, at about 110°, yields silver iodide without any evolution of iodine. Potassium perchlorate at above 200° yields abundance of chlorine, leaving a residue of nitrate with a small quantity of chloride; this is attributed to secondary reactions resulting from the high temperature. Barium periodate behaves in a similar manner.

Lead chromate is not attacked at above 400°, but above 300° silver chromate yields silver, silver nitrate and nitrite, and chromic oxide. Silver sulphate is slightly attacked at the highest temperature.

Mixing lead or manganese dioxide with lead nitrate caused the action to take place at a lower temperature than when either the oxide or salt was separately exposed to nitric oxide. D. A. L.

Tempering of very hard Steel. By FLORIS OSMOND (*Compt. rend.*, 1895, **121**, 684—686).—If a bar of cementation steel in which the proportion of carbon varies continuously from, say, 0·35 per cent. at one end to 1·70 per cent. at the other, is given a very high temper, it is found that it can be scratched by a needle up to 0·70 per cent. of carbon, cannot be scratched with a higher proportion up to 1·3 per cent., but beyond this point can again be scratched. Microscopic examination shows, however, that the more carbonaceous part is not homogeneous, but contains two constituents: A, which is scratched by glass and orthoclase, although not by a needle; and B, which is scratched by apatite and perhaps by fluorspar. On a well-polished surface, B is silver-white, whilst A is greyish. The action of iodine solution or of dilute nitric acid shows that the mass consists of polyhedra, sometimes separated, sometimes not, by the carbide Fe_3C. Generally, A is distributed in pointed lamellæ parallel with two directions which remain constant for each polyhedron, whilst B forms the matrix. Both A and B contain carbon. The constituent A is identical with that which is almost the only constituent of tempered steel containing 1 per cent. of carbon. The proportion of B increases with the proportion of carbon up to about 1·6 per cent., and beyond this point the carbide Fe_3C (?) separates in increasing quantities.

In order to obtain the maximum proportion of B, the steel must be heated to at least 1000°, although nothing is gained by going beyond 1100°, and cooled as rapidly as possible, either in ice-cold water or in very cold mercury, otherwise the carbide Fe_3C separates. Under favourable conditions, the metal will be a mixture of A and B, in approximately equal quantities. Such a mixture is comparatively feebly magnetic, whilst a bar of the same metal heated at 800° and cooled in water at 15° is strongly magnetic, and retains permanently a higher proportion of the magnetisation imparted to it. It would seem that B is not magnetic. The metal containing equal parts of A and B cannot be filed, and breaks without bending, as much by reason of the presence of the hard and brittle constituent A as because of the want of cohesion between the polyhedra. It is, however, slightly malleable.

The properties of B seem to be similar to those of highly nickeliferous and manganiferous steels, which contain iron in the allotropic form γ, stable above 860°. C. H. B.

Reduction of Iron Oxides by Carbonic Oxide. By Isaac Braithwaite (*Chem. News*, 1895, **72**, 211).—At a low red heat, carbonic oxide is found to be oxidised more readily by ferric oxide than by triferric tetroxide, whilst ferrous oxide is still less active. Conversely, carbonic anhydride is reduced more quickly by iron than by ferrous oxide, and not at all by triferric tetroxide. D. A. L.

Action of Silicon on Iron, Chromium, and Silver. By Henri Moissan (*Compt. rend.*, 1895, **121**, 621—626).—*Iron silicide*, $SiFe_2$, is obtained (1) by heating iron to the softening point of porcelain in a porcelain dish brasqued with silicon. (2) By heating iron with one-tenth its weight of silicon in a crucible in the electric furnace for four minutes with an arc from a current of 900 ampères and 50 volts. With a higher proportion of silicon, the product is not attacked by acids. (3) By heating in the electric furnace a mixture of ferric oxide with excess of silicon, silica being volatilised.

In all cases, the product is treated with nitric acid diluted with four times its volume of water.

The iron silicide forms small, magnetic, prismatic crystals, with a metallic lustre; sp. gr. = 7·00 at 22°. Its melting point is higher than that of cast iron and lower than that of wrought iron. Hydrofluoric acid attacks it readily, and hence it is not identical with the silicide which Hahn described as not attacked by this acid. Hydrochloric acid slowly attacks the finely powdered silicide; nitric acid has no action, but aqua regia decomposes it, with formation of silica. The gaseous hydracids attack it at temperatures varying from dull to bright redness. Potassium nitrate and chlorate, at their melting points, have no action on it; fused alkali carbonates attack it slowly, and a fused mixture of a nitrate and a carbonate decomposes it readily.

When cylinders of soft iron are embedded in crystals of silicon and heated at the temperature of a good forge, the silicon penetrates to the centre of the cylinders, although the iron does not fuse, and a silicide is formed. This result is a further proof that silicon has a distinct vapour tension below its melting point.

Chromium silicide, $SiCr_2$, is obtained (1) by heating chromium in a dish lined with silicon at a temperature somewhat above 1200° in a current of hydrogen. (2) By heating pure chromium with 15 per cent. of its weight of silicon in a carbon crucible in an electric furnace for nine minutes with an arc from a current of 900 ampères and 50 volts. (3) By heating in the electric furnace for ten minutes with an arc from a current of 950 ampères and 70 volts, a mixture of 60 parts of silica, 200 parts of chromic oxide, and 70 parts of sugar-carbon. The product is treated with cold concentrated hydrofluoric acid, the temperature being kept down, if necessary, by the addition of water. The silicide forms small, prismatic crystals, very similar in properties to the iron silicide, but less easily attacked by hydrofluoric acid, and more easily by fused potassium nitrate. It scratches quartz, and even corundum, quite easily.

Silver, when heated with silicon in the electric furnace, dissolves a considerable quantity, but the silicon separates as the metal cools, and no silver silicide is obtained, nor does the silver retain any silicon. Some crystals of carbon silicide are often formed.

It follows that (1) solid silicon may unite with a solid metal by reason of its vapour tension, in a manner analogous to cementation; (2) liquid silicon unites with a liquid metal; and (3) silicon may dissolve in a liquid metal, forming either a very unstable compound or no compound at all, and being liberated in a crystalline state as the metal solidifies. C. H. B.

Some Alloys of Iron with Molybdenum, Tungsten, and Chromium. By James S. de Benneville (*J. Amer. Chem. Soc.*, 1894, **16**, 735—757).—The alloys of iron with the metals of the tungsten group have been examined; they were prepared by melting down cast iron with the metals at a white heat in a small Fletcher's furnace working with a blast, this temperature being maintained for one hour. Whereas unalloyed molybdenum is practically infusible in furnaces worked with a blast, its iron alloys fuse at a much lower temperature. Molybdenum alloys, containing 16·6 and 29·8 per cent. of the metal, were prepared, and tungsten alloys containing 46·5 and 17 per cent. of tungsten, whilst with chromium, only a single alloy, containing 7 per cent. of that metal, was prepared. The physical properties of these alloys were noted, but the especial object of the investigation was the action of the weak solvent, silver nitrate, on the alloys, together with their behaviour with liquid and fused solvents. The more important conclusions drawn from the results thus obtained are: That these alloys, by their resistance to chemical reagents, their hardness and increased specific gravity, indicate a chemical union between the constituents. That in these alloys a number of compounds are present, some of which are more stable than others, the latter class being readily attacked by weak solvents. That these compounds are distributed with considerable uniformity throughout the mass of the alloy, segregation being the exception, not the rule, and that their freezing points must be approximately the same, preventing the segregation of alloys of great density in any one portion of the alloy; that the more stable of these alloys are definite chemical compounds; that the less stable may be definite compounds, or of the nature of cryohydrates, or with one of the constituents present in the mixture in a state analogous to that of ice in a frozen salt solution, in which water is in excess. J. J. S.

Two Definite Carbides of Iron with Chromium (Molybdenum and Tungsten). By James S. de Benneville (*J. Amer. Chem. Soc.*, 1895, **17**, 791—801).—In the course of his work on ternary alloys of iron with chromium, molybdenum, and tungsten, the author prepared two definite carbides. These were obtained from chromium alloys, and only from those two in which chromium was the predominant metal. They formed well defined crystals, differing in form and reactions from the matrix in which they were embedded. The separation of the crystals was effected by the action of nitric acid, which left them intermixed with a little silica. This was removed as silicon fluoride, and, after washing with water and subsequently with alcohol, the crystals were obtained free from impurity. They are remarkably inert, not being acted on by hydrochloric, nitric, or hydrofluoric acid. Concentrated sulphuric acid slowly decomposes them, leaving a black residue; they are readily decomposed at a red heat by chlorine, bromine, or iodine, but their analysis is best effected by fusing with a mixture of sodium carbonate and hydroxide, and potassium nitrate. The results obtained were

	Fe.	Cr.	Mo.	W.	C.	Total.
I.	46·39	46·23	2·01	—	5·53	100·16
II.	47·24	35·42	—	11·39	5·95	100·00

J. J. S.

The Ferrates. By Claude A. O. Rosell (*J. Amer. Chem. Soc.*, 1895, **17**, 760—769).—This paper opens with a short history of the ferrates, mentioning the work of Stahl, Ekeberg, Becquerel, Fremy, Denham Smith, Rose, and Bloxam.

The author has attempted to prepare sodium ferrate in the dry way, according to Stahl's method, by calcining ferric oxide with sodium hydroxide, carbonate and nitrate, and with mixtures of sodium hydroxide and nitrate, and also with sodium nitrate and carbonate, but in vain. Sodium peroxide was also tried, and, when the resulting mixture was treated with ice instead of water, a solution of sodium ferrate was obtained. Attempts to obtain iron dioxide by the action of an alkaline ferric solution on the solution of the ferrate, or by the addition of barium ferrate to a solution of ferric chloride, proved useless.

The most stable ferrate is the barium compound, $BaFeO_4 + H_2O$; whereas calcium ferrate is readily soluble in water, the barium compound is insoluble; before drying, it is readily decomposed by all acids, even carbonic, but after drying it is not so readily acted on. An alkali sulphate decomposes barium ferrate, if it has not been dried, with the formation of barium sulphate and ferric hydroxide, oxygen being set free. It is further shown, that the emerald green solution obtained by Fremy on passing hydrogen sulphide through a solution of sodium ferrate, is due to the presence of manganese. The question as to whether ferrates more closely resemble chromates or manganates is discussed. So far as their oxidising properties are concerned, they resemble the manganates; a ferrate will readily oxidise nitrites, tartrates, and glycerol; the soluble ferrates are also reduced by oxalates, alcohol, urea, ether, ammonia, &c., and by most soluble organic compounds, with the exception of the acetates. The simplest method for preparing solutions of sodium or potassium ferrate is to pass chlorine into a solution of the corresponding hydroxide, containing ferric hydroxide in suspension. J. J. S.

Nickel and Cobalt Silicides. By VIGOUROUX (*Compt. rend.*, 1895, **121**, 686—688).—When nickel or cobalt is heated with 10 per cent. of silicon in a current of hydrogen, in a reverberatory furnace, combination takes place, with formation of a crystalline product more fusible than the metal. Similar results are obtained by heating the silicon and the metal in a Doulton crucible in an oxyhydrogen furnace. Heating silicon with the oxides of the metals in either form of furnace does not yield a pure product. The best results are obtained by heating the metals with 10 per cent. of silicon, in carbon crucibles in the electric furnace, until the greater part of the excess of the metal is volatilised. The product is treated with very dilute nitric acid.

The silicides, $SiNi_2$ or $SiCo_2$, are perfectly crystallised, and have a metallic appearance, and a steel-grey colour; they are more fusible than the metal or silicon, and are stable at the highest temperatures. The sp. gr. of the nickel silicide is 7·2 at 17°, and that of the cobalt silicide 7·1. Fluorine attacks them with incandescence at the ordinary temperature, and chlorine has the same effect at a red heat; bromine and iodine are less energetic in their action. Dry hydrogen fluoride and hydrogen chloride attack them at a red heat, and hydrogen bromide and iodide behave similarly. Hydrofluoric acid dissolves them readily, but the other haloïd acids act very slowly; aqua regia, however, decomposes the powdered substances completely. Water has no action on the crystals, but water vapour attacks them at a dull red heat. Oxygen or air oxidises the finely powdered silicides at a red heat. Solutions of alkali hydroxides are without effect, but fused alkali carbonates or mixtures of carbonates and nitrates decompose them readily. C. H. B.

New Solvents of Perchromic acid. By WILLIAM M. GROSVENOR, Jun. (*J. Amer. Chem. Soc.*, 1895, **17**, 41—43).—The author finds that ethylic acetate and valerate, amylic valerate, amylic chloride, amylic butyrate, formate, and acetate all dissolve perchromic acid, yielding blue solutions similar to that given by ether. Carbon bisulphide, benzene, light petroleum, turpentine, castor oil, wintergreen oil, bergamot oil, paraffin, chloroform, carbon tetrachloride, toluene, nitrobenzene, and aniline do not dissolve it.

The solution in ethylic acetate is the most stable, but even that turns colourless after 23 hours. The author does not agree with Griggi (Abstr., 1893, ii, 233) in stating that the solution in amylic alcohol is more stable than that in ordinary ether. J. J. S.

Uranium Oxynitride and Uranium Dioxide. By EDGAR F. SMITH and J. MERRITT MATTHEWS (*J. Amer. Chem. Soc.*, 1895, **17**, 686—688).—To prepare the oxynitride, uranyl chloride was placed in a porcelain boat and heated in a current of dry ammonia, when, at a comparatively low temperature, the material assumed a dark colour, and copious fumes of ammonium chloride were evolved; the heat was then raised and continued until no more fumes were given off, and a dull black residue free from chlorine was left. This, when fused in a nickel crucible with potassium hydroxide, slowly evolved ammonia. When introduced into solution of silver nitrate, brilliant crystals of metallic silver were formed. When heated in a sealed tube with dilute sulphuric acid (1—2), complete solution ensued, and titration with potassium permanganate showed that 6·83 per cent. of dioxide was present. An estimation of the uranium and the nitrogen gave figures closely corresponding with the formula $U_{11}N_6O_{25}$.

In order to obtain the dioxide, the authors heated the oxide, U_3O_8, with a large excess of ammonium chloride in a porcelain crucible, which was placed in a larger Hessian one, and the whole surrounded with charcoal closely packed; the crucibles were heated in a wind furnace at a white heat for about six hours. The reddish-brown residue was free from chlorine and nitrogen; the percentage of uranium was found to be 88·12 per cent. When heated over a Bunsen flame, it changed gradually, but completely, into uranouranic oxide. L. DE K.

Alloys of Copper and Tin. By FRITZ FOERSTER (*Zeit. anorg. Chem.*, 1895, **10**, 309—319).—The author has prepared alloys of copper and tin containing from 1 to 28 per cent. of copper. These alloys, when broken in coarse pieces and treated with cold, fuming, hydrochloric acid, yield, a grey, lustrous, crystalline residue consisting of hard, brittle lamellæ. In the case of the alloy containing only 1 per cent. of copper, minute, lustrous needles were also obtained. These crystalline residues are only slightly attacked by ammonia, and very slowly oxidised by dilute nitric acid. They precipitate copper from neutral solutions of its salts, although much more slowly than pure tin, but do not precipitate copper from a solution of cuprous chloride in hydrochloric acid. The composition of the residues varies from 38·52 per cent. Cu and 61·42 per cent. Sn to 55·95 per cent. Cu and 43·67 per cent. Sn. The residue, containing 55·95 per cent. of copper, when treated with strong hydrochloric acid for 2—3 days, yielded a residue containing 61·47 per cent. Cu and 38·88 per cent. Sn. These residues probably contain mixtures of two compounds of the composition Cu_3Sn and CuSn. The residues obtained from the alloys poorest in copper have the same composition as those obtained from those portions of an alloy richer in copper which remain fluid longest, that is, the crystals first deposited are richer in copper than those obtained at a lower temperature from the mother liquor. The residues richest in tin begin to decompose when heated above 300°, whereby drops of tin or of a dilute solution of copper in tin are separated; this can be dissolved out by treating the mixture with hydrochloric acid, and the residue thus obtained approaches the compound Cu_3Sn in composition (see also Le Chatelier, Abstr., 1895, ii, 351).

E. C. R.

Action of Hydrogen Peroxide on Fluorides and Oxyfluorides. By Augusto Piccini (*Zeit. anorg. Chem.*, 1895, **10**, 438—445).—*Potassium fluoroxypertitanate*, $TiO_2Fl_2,2KFl$, is obtained mixed with the fluorotitanate when a hot solution of potassium fluorotitanate, $TiFl_4,2KFl,H_2O$, is treated with hydrogen peroxide. When this precipitate is dissolved in hydrogen peroxide and the mixture neutralised with sodium peroxide, a crystallisation richer in fluoroxypertitanate is obtained, but the salt cannot be obtained pure. A fairly pure product is obtained as a yellow, crystalline powder, when a cold solution of triammonium fluoroxypertitanate, $TiO_2Fl_2,3NH_4Fl$, is precipitated with potassium chloride.

Ammonium fluoroxypertitanates, $mTiO_2Fl_2,nNH_4Fl$. When a solution of ammonium fluorotitanate is treated with hydrogen peroxide in the presence of ammonia and ammonium fluoride, the *salt*, $TiO_2Fl_2,3NH_4Fl$, is obtained as a yellow precipitate. It crystallises from water in small, yellow octahedra. It is also obtained by treating a solution of titanic acid in sulphuric acid with barium peroxide, then with ammonia until a permanent precipitate is formed, and finally precipitating with neutral ammonium fluoride. It is also obtained by allowing ammonium fluorotitanite, $TiFl_3,3NH_4Fl$, washed with a concentrated solution of ammonium fluoride, and moistened with alcohol to oxidise in the air. A small quantity of the salt, $2TiO_2Fl_2,3NH_4Fl$, crystallising in yellow needles, is also obtained. If the solution of the salt obtained by the last method is mixed with ammonium fluoride, a crystalline precipitate of the salt $TiO_2Fl_2,3NH_4Fl$, is obtained.

From the results here obtained and the author's previous work (*Zeit. anorg. Chem.*, **1**, 51, and **2**, 21), the action of hydrogen peroxide on the oxyfluorides of molybdenum, tungsten, and niobium, and on the fluorides of tantalum and titanium can be expressed by the following equations. $MoO_2Fl_2 + H_2O_2 = MoO_3Fl_2 + H_2O$. $WO_2Fl_2 + H_2O_2 = WO_3Fl_2 + H_2O$. $NbOFl_3 + H_2O_2 = NbO_2Fl_3 + H_2O$. $TaFl_5 + H_2O_2 = TaO_2Fl_3 + 2HFl$. $TiFl_4 + H_2O_2 = TiO_2Fl_2 + 2HFl$. The fluoroxyanhydrides of the type of hydrogen peroxide react with metallic fluorides, whereby compounds are formed corresponding with those obtained from the fluoroxyanhydrides and the fluoranhydrides of the type of water. The fluoroxy-salts of the type of hydrogen peroxide are analogous in composition and crystalline form to those of the type of water. They can be obtained in analogous ways, but differ from the latter in colour, in the ease with which they give up part of their oxygen and in the property they possess of reducing potassium permanganate in acid solution.

E. C. R.

Double Fluorides of Cæsium and Zirconium. By HORACE L. WELLS and H. W. FOOTE (*Zeit. anorg. Chem.*, 1895, **10**, 434—437).—The double salts are prepared by mixing the solutions of the fluorides in various proportions in the presence of more or less hydrofluoric acid, and then evaporating the mixture to crystallisation.

The *salt*, $2CsF,ZrF_4$, is obtained by employing an excess of cæsium fluoride. It crystallises in large, hexagonal tablets, and can be recrystallised without decomposition.

The *salt*, $CsF,ZrF_4 + H_2O$, is obtained in the presence of larger quantities of zirconium fluoride. It separates in monoclinic crystals, and can be recrystallised without decomposition.

The *salt*, $2CsF,3ZrF_4 + 2H_2O$, is obtained in the presence of a large excess of zirconium fluoride. It separates from the solution in small, sparingly soluble crystals, and when recrystallised is partially converted into the 1 : 1-salt. E. C. R.

Action of Phosphorus Pentachloride on Zirconium and Thorium Dioxides. By EDGAR F. SMITH and HARRY B. HARRIS (*J. Amer. Chem. Soc.*, 1895, **17**, 654—656).—The work was undertaken to complete the investigation commenced by Weber.

The dioxides of zirconium and thorium were introduced into hard glass tubes together with the equivalent of phosphorus pentachloride; the tubes being then exhausted and sealed. After heating for eight hours at 190°, a complete change was observed, a crystalline mass and drops of phosphorus oxychloride being scattered through the tube. After opening the tube at both ends, the contents were heated in a current of chlorine, part of the tube being heated in an air bath at 190°, when large, transparent crystals collected in the projecting cold part of the tube. Analysis proved them to consist of the corresponding chlorides. L. DE K.

Iridio-ammonium Compounds. By WILHELM PALMAER (*Zeit. anorg. Chem.*, 1895, **10**, 320—386; see also Abstr., 1889, 352, and 1891, 402 and 1165).—When iridium chloride is treated with ammonia in an ordinary reflux apparatus, about 48 per cent. of a double salt of the composition $Ir(NH_3)_3Cl_3$ is obtained, together with the pentamine chlorochloride, a tetramine compound, $Ir(NH_3)_4Cl_3,H_2O$, and the aquopentamine chloride, $Ir(NH_3)_5OH_2Cl_3$. When 50 c.c. of a solution of iridium trichloride, containing 5 grams of metal mixed with 150 c.c. of 25 per cent. ammonia, is heated in a Lintner's pressure flask at 100° for 10 hours, the following products are obtained. Iridium hydroxide corresponding with 0·11 gram of metal. This is separated by filtration, and the filtrate evaporated on the water bath to dryness, whereby all the aquopentamine chloride is converted into pentamine chlorochloride. The dry residue is treated with cold water, whereby ammonium chloride and the tetramine chloride are dissolved. The residue insoluble in cold water is dried on the water bath and treated with cold concentrated sulphuric acid, whereby chlorosulphate is formed, and any double salt (about 1 gram) which is present remains undissolved. The sulphuric acid solution is finally treated with fuming hydrochloric acid, and the pentamine chloride filtered off. 7·4 grams are obtained.

Iridiopentamine chlorochloride, $Ir(NH_3)_5ClCl_2$, has already been described (Abstr., 1891, 402). The red coloration of the salt prepared as above is due to a very minute trace of iridium trichloride, which can be separated by treating the hot aqueous solution with hydrogen sulphide. It crystallises in yellowish-white octahedra; when heated at high temperatures, it yields metal, ammonium chloride, and ammonia; it is completely precipitated from its aqueous solution by hydrochloric acid.

The *chlorhydroxide*, $Ir(NH_3)_5Cl(OH)_2$, is obtained by treating the chlorochloride with freshly prepared silver oxide. It is very stable, absorbs carbonic anhydride from the air, and is slowly decomposed when boiled with water. It is also obtained by warming the chlorochloride with sodium hydroxide on the water bath. The *acid chlorosulphate*, $4Ir(NH_3)_5ClSO_4 + 3H_2SO_4 + 3H_2O$, is obtained by dissolving the chlorochloride (1 gram) in concentrated sulphuric acid (2 c.c.) and then adding water (10 c.c.). It crystallises in lustrous, bright yellow prisms, is easily soluble in water, and has an acid reaction. The *chlorodithionate*, $Ir(NH_3)_5ClS_2O_6$, is obtained by adding barium dithionate to a cold saturated solution of the chlorochloride. It crystallises in long, six-sided prisms, and with $1H_2O$ in thick, four-sided prisms. The *chloroxalate*, $Ir(NH_3)_5ClC_2O_4$, crystallises in slender, white needles.

Iridiopentamine chlorochloriridite, $3Ir(NH_3)_5ClCl_2 + 2IrCl_3$, is obtained by mixing the solution of the chlorochloride with one of the trichloride as a flocculent precipitate, and from the remaining solution as a crystalline, yellow powder on evaporating it on the water bath. It is only slowly attacked by sulphuric acid at 110°, and is decomposed by heat, yielding iridium, ammonium chloride, and hydrogen chloride. The pentamine chloro-salts here mentioned, together with those previously described, are neutral, with the exception of the acid sulphate and the nitrite which has an alkaline reaction.

Iridiopentamine bromobromide, $Ir(NH_3)_5BrBr_2$, has been previously described. It is best obtained by boiling the pentamine chlorochloride with potassium hydroxide for about five hours, when the aquopentamine hydrate is formed. The solution is saturated with 50 per cent. hydrobromic acid, whereby a white, crystalline precipite of the aquopentamine bromide, $Ir(NH_3)_5OH_2Br_3$, is obtained, and, by heating the solution of the latter salt on the water bath, it is converted into the bromobromide. This crystallises in yellow, rhombic prisms, $a : b : c = 0{\cdot}9752 : 1 : 1{\cdot}5687$, is soluble in 352 parts of water at 12·5°, and has a sp. gr. of 3·245 at 16·5°. The bromonitrite crystallises in yellow, rhombic prisms, $a : b : c = 0{\cdot}969 : 1 : 1{\cdot}535$, and is isomorphous with the pentamine chloronitrite.

Iridiopentamine iodoiodide, $Ir(NH_3)_5II_2$, is obtained by heating the aquopentamine hydrate at 100°. It crystallises in thick six-sided prisms and octahedra, belonging to the rhombic system $a : b : c = 0{\cdot}993 : 1 : 1{\cdot}552$, is soluble in 770 parts of water at 14°, and 50 parts of boiling water, and has the sp. gr. of 3·586 at 15·5°.

Iridiopentamine nitratonitrate, $Ir(NH_3)_5NO_3(NO_3)_2$, is obtained by heating the aquopentamine nitrate at 100°. It crystallises in microscopic, quadratic tablets, explodes when heated, dissolves in 349 parts of water at 16° and in 40 parts of boiling water, and has the sp. gr. of 2·510 at 18·5°.

Iridioaquopentamine chloride, $Ir(NH_3)_5OH_2Cl_3$, the aquopentamine bromide and the aquopentamine nitrate have already been described.

Iridioaquopentamine iodide, prepared in a similar way to the above aquopentamine salts, is a white, crystalline powder, having a yellowish-brown fluorescence; it is converted into the pentamine iodide when heated, dissolves in 15 parts of water, and has the sp. gr. of 3·353 at 14°. The *aquopentamine chloriridite*, $Ir(NH_3)_5OH_2Cl_3,IrCl_3$, is obtained by adding iridium trichloride to a solution of the aquopentamine chloride in dilute hydrochloric acid. It is a yellowish-brown, crystalline precipitate, insoluble in water, and is not attacked by cold, concentrated sulphuric acid.

Iridiohexamine chloride, $Ir(NH_3)_6Cl_3$, is obtained by heating the pentamine chlorochloride (2 grams) with 25 per cent. ammonia (20 c.c.) in a sealed tube at 140° for 48 hours. The product is evaporated to dryness with hydrochloric acid, dissolved in water, and the filtered solution precipitated with sodium pyrophosphate. The washed precipitate of iridiohexamine sodium pyrophosphate is dissolved in dilute hydrochloric acid and precipitated with nitric acid, whereby the hexamine nitrate is obtained. The nitrate is then evaporated to dryness two or three times with hydrochloric acid, and the solution of the product cooled with ice and precipitated with ice-cold, fuming hydrochloric acid. It crystallises in large, colourless, six-sided prisms belonging to the monosymmetric system $a : b : c = 0{\cdot}5843 : 1 : 0{\cdot}6502$; $\beta = 57° 31'$, and gives measurements very closely agreeing with those of Klein's luteocobalt chloride (*Annalen*, **166**, 188). It is soluble in 4·5 to 5 parts of water, and has the sp. gr. of 2·4335 at 15·5°. The *hexamine hydroxide*, $Ir(NH_3)_6(OH)_3$, is obtained in solution by treating the preceding salt with silver oxide. The solution is strongly alkaline, displaces ammonia from ammonium salts, and gives precipitates of the metallic hydroxides with solutions of aluminium and zinc salts. On exposure to air, it is converted into the carbonate which crystallises in crusts of microscopic six-sided tablets. The *hexamine bromide*, $Ir(NH_3)_6Br_3$, obtained by precipitating a solution of the nitrate with hydrobromic acid, crystallises in colourless six-sided prisms similar to those of the hexamine chloride; it is soluble in 28—30 parts of water, and has the sp. gr. of 2·942 at

15·5°. The *hexamine iodide*, $Ir(NH_3)_6I_3$, is obtained by treating the hexamine hydroxide with excess of hydriodic acid. It crystallises in yellowish, lustrous tablets and pyramids, gives off iodine vapours when heated, is soluble in 91 parts of water at 18°, and has the sp. gr. of 3·291 at 16·5°. The *hexamine nitrate*, $Ir(NH_3)_6(NO_3)_3$, crystallises in large, quadratic tablets belonging to the tetragonal system $a : b = 1 : 1·042$, and isomorphous with the luteocobalt nitrate; it is soluble in 59 parts of water at 14°, and has the sp. gr. of 2·395 at 15°. *Iridiohexamine ferricyanide*, $Ir(NH_3)_6Fe(CN)_6$, is obtained by adding potassium ferricyanide to a solution of the hexamine chloride in hydrochloric acid. It crystallises in orange-red prisms, and is very sparingly soluble in water. *Iridiohexamine chloriridite*, $Ir(NH_3)_6Cl_3,IrCl_3$ is obtained as an amorphous, yellowish precipitate which is greyish-yellow when dry. From dilute solutions, it separates in small, quadratic tablets. It is insoluble in cold water, is attacked by concentrated sulphuric acid at 190°, and, when boiled with it, yields a clear, bright yellow solution. The solutions of the hexamine salts are neutral.

The reactions of the various classes of salts are described in detail in the original paper. E. C. R.

Mineralogical Chemistry.

Native Sulphur in Michigan. By W. H. SHERZER (*Amer. J. Sci.*, 1895, [3], **50**, 246—248).—In a band of carbonaceous limestone in the Upper Helderberg Limestone of Monroe Co., are cavities containing calcite, celestite, sulphur, and rarely selenite. In the same quarry is a stream of water highly charged with hydrogen sulphide, from which sulphur is now being deposited. It is suggested that the hydrogen sulphide has been derived from pyrites, marcasite, &c., or, perhaps, from the organic matter in the neighbouring rocks.

L. J. S.

Black Carbonado from Brazil. By HENRI MOISSAN (*Compt. rend.*, 1895, **121**, 449—450).—A specimen of carbonado found in the province of Bahia, Brazil, weighed 630 grams (or 3073 carats), and is the largest that has yet been found. It is rounded in form, has a full black colour, and resembles in the character of its surface, &c., the microscopic grains of carbon obtained from ingots of silver or iron compressed by sudden external cooling. It is somewhat porous, and originally weighed 3167 carats, but lost about 19 grams during exposure to air for two months. C. H. B.

Graphite from a Pegmatite. By HENRI MOISSAN (*Compt. rend.*, 1895, **121**, 538—541).—An American pegmatite, containing 12·77 per cent. of graphite, was decomposed by means of hydrofluoric acid. The graphite was thus obtained in flexible, lustrous lamellæ, the surfaces of which showed striæ in the form of equilateral triangles; it began to burn in oxygen at 690°, and left 5·01 per cent. of ash, which consisted mainly of silica, alumina, and calcium oxide, with only a trace of iron. The graphite was intumescent like that obtained by dissolving carbon in metals. Moreover, when treated with nitric acid and potassium chlorate, it increases enormously in volume.

Microscopic examination of the pegmatite proved that the faces of the crystals of quartz or felspar in contact with the lamellæ of graphite showed triangular striæ precisely similar to the striæ on the lamellæ. It follows that the graphite must have been pre-existent in the material from which the pegmatite was formed, and when the latter solidified, the graphite was compressed between the crystals of quartz or felspar. C. H. B.

Gallium and Indium in a Blende from Peelwood, N.S.W. By J. Booth Kirkland (*Australian Assoc. Adv. Sci., Fourth Report*, [1892] 1893, 266—267).—A peculiar, grey zinc ore from the above locality showed by the spectroscope the lines of gallium and indium. Crude chlorides of these metals have been extracted. Analysis of the ore gave

SiO_2.	Pb.	Fe.	Cu.	Zn.	S.	Total.
6·05	16·71	11·06	5·00	29·77	29·21	97·70

L. J. S.

The Senarmontite of Nieddoris, and the Minerals which accompany it, Arite, Breithauptite, Gersdorffite, and Smaltite. By Domenico Lovisato (*Jahrb. f. Min.*, 1895, ii, Ref., 230—231; from *Atti R. Acc. Lincei, Rend.*, 1894, **3**, 82—89).—The nickel ores of Nieddoris, in the mining district of Arbus, Sardinia, consist of a mixture of several minerals. Of these a light red mineral gave analysis I; this agrees with arite, and has the formula $9RAs + 5RSb$. A dark red ore gave II, this agreeing with the formula $RAs + 4RSb$, and is thus a mixture consisting principally of breithauptite. A dark, black mineral gave III, agreeing with the formula $(Ni,Fe,Co)_2(S,As,Sb)_3$, which comes near to gersdorffite, with, perhaps, some admixed ullmannite. The silver-white portion of the ores gave IV (with 2·14 per cent. of gangue), agreeing with the formula $(Ni,Fe,Co)As_2$, and corresponding with smaltite (or chloanthite).

	S.	As.	Sb.	Ni.	Co.	Bi.	Fe.	Zn.	Pb.	Total.
I.	0·85	29·82	26·57	36·81	3·91	0·99	0·98	trace	—	99·93
II.	1·00	8·42	23·63	60·07	3·65	1·55	1·81	—	—	100·13
III.	13·72	44·78	3·11	35·12		0·91	2·36	—	—	100·00
IV.	2·94	58·76	1·06	9·85	7·65	—	9·86	0·72	6·33	97·17

IV contained in addition 2·14 of gangue.

Senarmontite and valentinite occur with these ores.

L. J. S.

Hercynite from Valtellina. By Gottlob Ed Linck (*Ber. Akad. Berlin*, 1893, 47—53).—In an altered gabbro, from near the Italian-Swiss frontier, are large, black, fine-grained masses, containing black grains of a spinel, sometimes showing octahedral faces, together with plagioclase, biotite, sillimanite, corundum, rutile, and a yellowish metallic ore. In sections, the spinel is green and transparent, and often encloses what appears from the analyses to be pyrrhotite. On crushing the mass some hydrogen sulphide is given off. Analysis of the magnetic spinel and pyrrhotite gave I; II is the same neglecting impurities; sp. gr. of the pure material, 4·0108.

Al_2O_3.	Fe_2O_3.	FeO.	MgO.	SiO_2.	Fe.	S.	Total.
59·62	3·10	25·30	9·38	1·59	1·79	1·02	101·80
61·21	3·18	25·98	9·63	—	—	—	100·00

This gives $R_2O_3 : RO = 6200 : 6016$, the FeO being too low. Hercynite can only be distinguished from other green spinels by analysis. L. J. S.

Northupite, a new Mineral. By WARREN M. FOOTE (*Amer. J. Sci.*, 1895, [3], **50**, 480—481).—This was found by C. H. Northup, in clay at Borax Lake, California, as regular octahedra, of a dirty white to dark brown colour. Cleavage imperfect; brittle, with uneven fracture; H = 3·5—4. There are regularly arranged enclosures, probably of organic matter. When heated, the mineral blackens, and gives off a burnt odour, with violent decrepitation, owing to mechanically enclosed water; easily fusible. Qualitative analysis shows it to be a double chloride and carbonate of sodium and magnesium, together with traces of phosphoric acid, silica, iron, calcium, and organic matter. Boiling water decomposes the mineral with separation of basic magnesium carbonate. L. J. S.

Nature of Stinkstone (Anthraconite). By WILLIAM SKEY (*Trans. N.Z. Inst.*, 1893, **25**, 379—380).—The smell of stinkstone is usually considered to be due to bituminous matter; the author, however, considers that in most cases it is due to hydrogen sulphide, this gas being supposed to be occluded in the free state in the limestone, it not being given off at a red heat. Analysis of a light grey stone, free from bituminous matter, gave

$CaCO_3$.	$MgCO_3$.	FeO.	$CaSO_4$.	Siliceous matter.	Organic matter.	H_2O.	H_2S.	Total.
54·40	0·93	0·21	trace	42·44	0·21	0·89	0·31	99·39

L. J. S.

Optical Properties of Lithiophilite and Triphylite. By SAMUEL L. PENFIELD and JULIUS H. PRATT (*Amer. J. Sci.*, 1895, [3], **50**, 387—390).—As iron replaces manganese in the passage from lithiophilite ($LiMnPO_4$) to triphylite ($LiFePO_4$), it is shown that there is an increase in the refractive indices, and a gradual change in the size of the optic axial angle, as is seen in the following table, which gives part of the measurements obtained for sodium light.

Locality.	FeO per cent.	β.	2V over *b*.	Plane of optic axes.
Branchville, Conn.	4·24	1·675	65° 13′	(001)
„ „	9·42	1·679	62 54	(001)
„ „	13·63	1·682	56 4	(001)
Grafton, N.H.	26·58	1·688	—	Uniaxial
Rabenstein, Bavaria ...	35·05	1·702	120 0	(100)

The optically positive mineral from Grafton has for thallium light 2V = 21° 53′ in the plane (001), and for lithium light 2V = 15° 3′ in the plane (100). Lithiophilite is optically positive, and the acute bisectrix is perpendicular to (010); the Rabenstein triphylite is optically negative, and the acute bisectrix is perpendicular to (001). On plotting a curve, it is seen that a further increase in the amount of iron would cause 2V to become zero again, this time negative, with the optic axis perpendicular to (001); and as the pure compound $LiFePO_4$ (which is not known) is approached, it may be expected that the optic axis would open out in the plane (010).

L. J. S.

Genesis of Natural Phosphates and Nitrates. By É. J. Armand Gautier (*Jahrb. f. Min.*, 1895, ii, Ref., 276—279; from *Ann. des Mines*, 1894, [9], **5**, 1—53).—After describing the phosphates of the Grotto of Minerva, Dept. Hérault (Abstr., 1893, ii, 419, 577), the author points out that there are three modes of occurrence of commercial phosphates: (1) in igneous rocks and gneisses; (2) in beds and veins, where they have been deposited from solution; (3) nodules and earthy deposits associated with calcium sulphate and carbonate, and nitrogenous organic matter, these being of animal and vegetable origin, and include guano deposits and those of the Grotto of Minerva. Here the ammonium phosphate, formed by the decomposing animal matter, acts on limestone, giving calcium phosphate and ammonium carbonate; the latter with limestone, in connection with nitrifying ferments, producing calcium nitrate. In an experiment, a warm ammoniacal solution of ammonium phosphate acted on an excess of chalk; the product contained 11·28 $Ca_3(PO_4)_2$ and 82·78 per cent. of dibasic calcium phosphate, or brushite ($CaHPO_4,2H_2O$). Similar reactions take place in the presence of clay (Abstr., 1893, ii, 536). The formation of phosphates and nitrates are thus connected; in the presence of sodium chloride, large nitre deposits, such as those of Peru, might be formed.

L. J. S.

Phosphates from Algeria. Phosphatic Rock at Bougie having the Composition of a Superphosphate. By H. Malbot and A. Malbot (*Compt. rend.*, 1895, **121**, 443—445).—Analyses are given of several Algerian phosphatic deposits; they consist mainly of mixtures of calcium and magnesium phosphates and carbonates, only traces of the phosphates being soluble in water, or in ammonium citrate solution. The deposit at Bougie, however, consists of a hard, red, internal portion, surrounded by a white, friable substance, the composition being as follows.

	Loss at 130°.	Loss at dull redness.	P_2O_5.	SO_3.	Soluble SiO_2.
White substance..	7·93	21·42	33·50	1·51	traces
Red substance....	12·20	9·87	14·42	2·53	0·37

	Fe_2O_3 and Al_2O_3.	CaO.	MgO.	Insoluble.
White substance......	4·33	25·51	0·28	14·00
Red substance........	16·35	4·37	0·35	52·07

In the case of the white substance, 13·29 per cent. of phosphoric anhydride is soluble in water, 8·51 is insoluble in water, but soluble in ammonium citrate solution, and the remaining 11·70 per cent. soluble in dilute acids; in the case of the red substance, 2·03 per cent. is soluble in water, and the remaining 12·39 per cent. is soluble in ammonium citrate solution.

When phosphoric acid is directly precipitated by magnesia mixture in presence of ammonium citrate from solutions containing organic matter, the results are too low. The organic matter, as a rule, is incompletely destroyed by evaporating with nitric acid, and the substance should be heated at dull redness in contact with air. Intermediate precipitation with ammonium molybdate avoids the error arising from the presence of organic matter. C. H. B.

Kentrolite from Långban. By GUSTAV FLINK (*Jahrb. f. Min.*, 1895, ii, Ref., 240; from *Bihang Vet. Akad. Hand.* (*Stockh.*), 1891, **16**, ii, No. 4).—Black, orthorhombic crystals of kentrolite occur with braunite, richterite, barytes, and calcite at Långban, Sweden. Analysis gave

SiO_2.	Mn_2O_3.	Fe_2O_3.	PbO.	MnO.	CaO.	Total.	Sp. gr.
17·68	16·59	5·58	55·72	3·05	0·91	99·53	6·068

The formula is given as $R_2''SiO_4 + R_2'''SiO_5$, where R'' is Pb : Mn : Ca = 33 : 5 : 2, and R''' is Mn : Fe = 3 : 1. L. J. S.

Thorium and Yttrium Minerals of Norway. By LUDWIG SCHMELCK (*Zeit. angw. Chem.*, 1895, 542—543).—The external characters, blowpipe reactions, action of acids, and approximate thoria and yttria percentages, are given of the various Norwegian minerals, which are used for the extraction of these oxides for incandescent lights: these minerals are thorite and orangite, æschynite, euxenite, fergusonite, gadolinite, orthite, monazite, xenotime, and keilhauite. The commercial thorite and orangite usually do not contain more than 45 and 60 per cent. of thoria respectively. L. J. S.

Analyses of Beryl. By JAMES S. DE BENNEVILLE (*J. Amer. Chem. Soc.*, 1894, **16**, 65—66).—In the following analyses special attention was paid to the alkalis. I, dull yellow, from Fahlun, Sweden. II, apple green, Black Mt., Buncombe Co., N.C. III and IV, light green, Acworth, N.H.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	K_2O.	Cs_2O.	Na_2O.
I.	64·02	16·44	0·68	12·91	0·23	0·50	2·76	—	0·25
II.	66·24	17·64	1·36	11·06	0·09	0·36	0·30	—	0·60
III.	65·23	17·72	1·35	12·37	0·37	0·61	0·35	—	0·53
IV.	66·53	17·11	0·94	12·24	0·20	0·43	0·22	0·12	0·97

	Li_2O.	H_2O.	P_2O_5.	Total.	Sp. gr.
I.	0·05	1·76	0·26	99·86	2·713
II.	0·14	2·06	0·78	100·63	2·748
III.	0·16	1·49	0·14	100·22	2·714
IV.	0·17	1·49	trace	100·45	2·730

L.

Analyses of the Emerald. By PAUL LEBEAU (*Compt. rend.*, 1895, **121**, 601—603).—An analysis was made of an average sample of about 30 kilos. of emerald from the neighbourhood of Limoges. The emerald was in large, crystallised fragments, and showed, as a rule, little colour; it contained manganese, phosphoric acid, titanic acid, and free fluorine, which have not previously been observed in emeralds from this locality.

SiO_2.	Al_2O_3.	BeO.	Fe_2O_3.	Mn_3O_4.	MgO.	CaO.	P_2O_5.	Loss on ignition.
65·93	16·25	14·27	1·05	0·12	0·58	0·16	0·10	1·44

with traces of alkalis and of TiO_2.

Some of the crystals contain veins of a dark coloured substance, and when powdered, or when treated with concentrated sulphuric acid, evolve a gas which has the odour of ozone. Becquerel and Moissan have shown that the odour of ozone observed in the case of the fluorspar from Quincié, under similar conditions, is due to the presence of free fluorine, which decomposes the moisture of the air. It would follow that the Limoges emeralds contain free fluorine or a perfluoride, and this is confirmed by the fact that the gas evolved by the action of sulphuric acid etches glass. C. H. B.

Optical Properties of some Compact and Earthy Silicates. By ALFRED LACROIX (*Compt. rend.*, 1895, **121**, 737—739).—The following ill-defined minerals, which appear to the eye to be compact or earthy, were all found, on examination under the microscope, to show an acute negative bisectrix, with an optic axial angle of varying size, perpendicular, or nearly so, to a good lamellar cleavage; these characters being analogous to those of the micas, it may be assumed that these minerals are monosymmetric: chrome-ochre, glauconite, celadonite, chamosite, berthierine, bavalite, aërinite, talc, meerschaum, clays related to halloysite (severite, lenzinite) and montmorillonite (confolensite, delanouite), and nontronite (pinguite and gramenite).

L. J. S.

Opal, Andalusite, Tourmaline, Sillimanite, Cordierite, Pinguite, and Hoeferite from Bohemia. By FRIEDRICH KATZER (*Tsch. Min. Mitth.*, 1895, **14**, 483—525).—*Opal* occurs in a pegmatite vein in the gneiss near Pisek, it being shown to have been derived, together with some kaolin, from the felspar. I is the analysis of the yellow opal, sp. gr. 2·294, and II of the bluish-white, sp. gr. 2·313.

	H_2O.	SiO_2.	Al_2O_3, Fe_2O_3.	CaO.	MnO.	MgO.	Alkalis [diff.].	Total.
I.	5·77	84·86	6·56	trace	trace	2·21	[0·60]	100·00
II.	5·35	90·62	3·18	trace	—	1·02	trace	100·17

Both are completely decomposed by hot hydrochloric acid, but only incompletely by aqueous potash, the insoluble portion (22·47 per cent. for the yellow, and 32·88 for the bluish-white) containing, besides opal, small quantities of kaolin, quartz, mica, limonite, hæmatite, psilomelane, felspar, nontronite and chalcedony.

Andalusite, in rose- to hyacinth-red, columnar masses, in a pegmatite vein near Čejov, gave analysis I for the dark, and II for the light coloured. The powder is rose-red, the colour becoming lighter on ignition. Secondary cordierite is intimately associated with the andalusite. III is the analysis of a very similar andalusite from a pegmatite vein near Sedlitz.

	SiO_2.	Al_2O_3.	Fe_2O_3.	Loss (H_2O).	K_2O.	Total.	Sp. gr.
I.	38·15	60·11	1·52	0·99	—	100·77	3·119
II.	38·52	60·59		0·99	—	100·10	
III.	37·34	60·84	1·40	1·27	trace	100·85	3·122

The varying quantity of silica, which is somewhat in excess of that required by the formula Al_2O_3,SiO_2, and the presence of water may indicate commencing decomposition.

Tourmaline.—A partial analysis of the black tourmaline, associated with the andalusite of Čejov, gave

H_2O.	SiO_2.	Al_2O_3.	FeO.	MnO.	MgO.	CaO.	Total.
2·24	38·01	31·72	12·47	trace	2·05	small quantity	86·49

It is intimately associated with what appears to be secondary muscovite. Sp. gr. 3·166.

Sillimanite occurs in the cordierite rock of Humpoletz in places where the effects of pressure on the rock are evident. The fine, colourless needles form a silver-white to yellowish aggregate, which has a silky lustre, and a hardness as low as 2 to 4. Analysis I is of the finely fibrous variety; II, of the more coarsely crystalline, which is closely associated with quartz.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Loss on ignition.	Total.	Sp. gr.
I.	37·11	60·54	trace	0·38	2·40	100·43	3·153
II.	43·12	55·81	—	0·42	0·99	100·34	—

Although the excess of silica in II is best explained by the presence of quartz, it may, perhaps, indicate an approach to $Al_2(SiO_4)_3$ (wörthite?).

Cordierite, from the cordierite rock of Humpoletz, gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	MnO.	Loss (H_2O).	Total.	Sp. gr.
50·13	32·11	2·24	6·37	8·47	0·32	0·99	100·63	2·696

This gives the formula $H_2O,6(Mg,Fe)O,6(Al_2,Fe_2)O_3,15SiO_2$; or, if the water be neglected $(Mg,Fe)_2(Al,Fe)_4Si_5O_{18}$.

Pinguite, of a yellowish-green colour, occurs in earthy masses with kaolin and sandy iron-ochre in a weathered schist at Spaniow, near Taus; it is supposed to have been produced by the action of sulphuric acid, derived from pyrites, on felspar. The mineral, on a fresh fracture, is greenish, and has a fatty appearance. H = 1; sp. gr. 2·727. It fuses with difficulty to a black, magnetic slag; it is completely decomposed by concentrated sulphuric acid. The mean of two analyses of air-dried material gave

Loss on ignition (H_2O).	SiO_2.	Fe_2O_3 (and a little FeO).	Al_2O_3.	CaO.	Total.
22·48	41·33	35·10	0·75	1·01	100·67

At 110°, 16·53 per cent. of water is given off; at 250°, 17·09 per cent. Formula, $Fe_2O_3,3SiO_2,5H_2O$, or $2Fe_2O_3,6SiO_2,3H_2O + 8Aq$.

Hoeferite, this new mineral from Křitz, near Rakonitz, has much the same mode of occurrence and origin as the pinguite described above. It is earthy and of a siskin-green colour with fatty lustre, H = 1—3. It is difficultly fusible to a black, magnetic slag; it is only partly decomposed by strong sulphuric acid, and not at all by hydrochloric acid or by aqueous potash. The material was purified by means of dilute acid, and after being air dried, gave on analysis

SiO_2.	Fe_2O_3 (and a little FeO).	Al_2O_3.	Loss on ignition.	Total.	Loss at 120°.	Sp. gr.
36·14	45·26	1·11	18·15	100·66	0·99	2·27
35·88	46·64		18·20	100·72	3·79	2·41

Formula $2Fe_2O_3,4SiO_2,7H_2O$. The points in which the mineral differs from nontronite, pinguite, and other chloropals are given. Schrauf's analysis of chloropal from Mugrau is reduced to a mixture of hoeferite and $CaO,3SiO_2,4H_2O$. L. J. S.

Zeolites of the Syenite near Dresden. By E. Zschau (*Abh. Ges. Isis*, 1894, (1893), 90—105).—The modes of occurrence of the various zeolites found in connection with the syenite of the Plauenscher Grund are described in detail. Brick-red, granular laumontite gave analysis I; this red mineral does not lose water and crumble, as the white does. Of the eight analyses given for analcite, II is of the massive, red mineral, and III of the white and crystalline. Red radiated natrolite gave IV; sp. gr. 2·243—2·266.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Na_2O.	H_2O.	Total.
I. Laumontite......	53·88	20·73	trace	9·28	1·97	13·96	99·82
II. Analcite (red)....	58·16	20·43	little	0·37	11·43	8·79	99·18
III. Do. (white)..	57·32	20·90	trace	0·31	11·45	9·18	99·16
IV. Natrolite........	48·04	26·17	trace	0·96	13·96	9·91	99·04

L. J. S.

Isomorphism of the Felspars (Albite-Anorthite). By Fr. Wallerant (*Compt. rend.*, 1895, **121**, 740—741).—As the optic axial angles calculated for the felspars, on the assumption that they are isomorphous mixtures of albite and anorthite, do not agree with the observed values, it is considered that the albite and anorthite molecules are chemically combined. L. J. S.

The Leucite-nepheline Group. By Carl F. Rammelsberg (*Ber. Akad. Berlin*, 1892, 543—561).—The minerals here considered form two dimorphous groups, represented by the cubic leucite and the hexagonal nepheline. Most are orthosilicates, but leucite, pollucite (and nepheline partly, as here shown) are metasilicates; these and other differences in the composition and formulæ of these isomorphous groups find an analogy in the felspars. The formulæ here given for pollucite, leucite, kaliophilite, eucryptite, and Doelter's artificial soda-nepheline are the usual ones. In *nepheline*, where the silica is in excess of the orthosilicate formula, the ratio Al : Si = 1 : 1·4 is assumed, giving the formula $R_{14}Al_{14}Si_{16}O_{60}$, or, as K : Na is often as 1 : 5, $6(Na_2Al_2Si_2O_8),K_2Al_2Si_4O_{12}$. This combination of an orthosilicate (soda-nepheline) with another salt (the metasilicate leucite) is what occurs in the sodalite group. This formula also explains the observed alteration of leucite into sanidine and nepheline as follows: $13R_2Al_2Si_4O_{12}$ (leucite) = $R_{14}Al_{14}Si_{16}O_{60}$ (nepheline) + $6R_2Al_2Si_6O_{16}$ (orthoclase).

Cancrinite (with davyne) is written as an isomorphous mixture of carbonate and silicate, as was done for the very similar artificial silico-carbonate (Abstr., 1887, 12), namely,

$$x(R'_4SiO_4),y(Ca_2SiO_4),z(Al_4Si_3O_{12}),$$

where R′ represents Na and H, and Si represents Si and C in varying amounts; $x = 2z$.

Sodalite is written as the isomorphous mixture

$$NaCl,Na_4SiO_4,Al_4Si_3O_{12};$$

here the ratio Cl : Si is 1 : 4, it may also be 1 : 3. Formulæ on the same lines are given for haüyne, nosean, and the hexagonal microsommite, the last being

$$3(4RCl,R_2SO_4,3R_4SiO_4,3Al_4Si_3O_{12}) + 2(2CaCl_2,CaSO_4,3Ca_2SiO_4,3Al_4Si_3O_{12}).$$

Lazulite, from Brögger and Bäckström's analysis, is deduced as $NaCl,4NaS_2,10Na_2SO_4,10Na_4Al_4Si_4O_{16}$, with part of the sodium replaced by calcium; deducting the artificial ultramarine from this, the haüyne formula is arrived at. L. J. S.

Ilvaite, Harmotome, Opal, Danaite, Scheelite, Chromiferous Muscovite, Gersdorffite, Nickeliferous Pyrrhotite from Canada.

By G. CHRISTIAN HOFFMANN (*Report Geol. Survey, Canada*, 1892, **5**, ii, R, 1—72).—*Ilvaite*, iron-black, associated with calcite, tremolite, and andradite, from Barclay Sound, Vancouver Island; sp. gr., 3·859.

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	H_2O.	Total.
29·81	0·16	18·89	32·50	2·22	13·82	0·30	1·62	99·32

Harmotome, small crystals on calcite, from O'Connor, Ontario; sp. gr., 2·39.

SiO_2.	Al_2O_3.	BaO.	CaO.	K_2O.	Na_2O.	H_2O.	Total.
46·36	17·16	21·18	2·25	?	?	14·54	101·49

Opal, common, white, or greenish, from basaltic breccias at Savona Mtn., B.C.; sp. gr., 2·012, after ignition, 2·083. It is nearly all soluble in caustic potash, the residue consisting of SiO_2 0·76, Al_2O_3 0·23, Fe_2O_3 0·26, CaO 0·35, MgO 0·23, alkalis ? 0·09 = 1·92 per cent. On ignition, there is a loss of 7·00 per cent. of water; of this, 3·25 per cent. is lost over sulphuric acid; the material dried over acid gains 6·75 per cent. in a moist atmosphere, and the original material gains 3·28 under similar conditions or when immersed in water. After ignition, water is not re-absorbed.

Danaite, massive, steel-grey, associated with nickeliferous pyrrhotite at Graham, Ontario; sp. gr., 5·988. An analysis by R. A. A. Johnston gave, after deducting 4·77 per cent. of quartz,

As.	S.	Fe.	Co.	Ni.	Sb.	Au.	Total.
42·22	18·84	33·32	4·09	0·93	0·60	trace	100·00

Scheelite, in pale wine-yellow crystals, associated with hæmatite, pyrrhotite, pyrites, and quartz at Marlow, Quebec, gave on analysis by Johnston,

WO_3.	CaO.	Fe_2O_3.	SiO_2.	Total.	Sp. gr.
79·90	19·37	0·70	0·29	100·26	6·059

Chromiferous muscovite, massive, bright emerald-green, from Matawatchan, Renfrew Co., Ontario, gave on analysis by F. G. Wait; sp. gr., 2·93.

SiO_2.	Al_2O_3.	Fe_2O_3.	Cr_2O_3.	MnO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
43·72	35·51	2·94	1·26	0·26	4·46	1·36	8·88	0·39	3·68	102·46

Gersdorffite, massive, or as crystals (octahedra or cubo-octahedra), steel-grey, associated with niccolite, pyrrhotite, &c., at Denison, Ontario; sp. gr., 6·231. Analysis by Johnston gave, after deducting 13·55 per cent. of quartz,

As.	S.	Ni.	Fe.	Co.	Cu.	Total.
46·96	16·71	26·32	7·90	2·01	0·10	100·00

Nickeliferous Pyrrhotite.—The results of the examination of 30 nickel ores are given; most of these are pyrrhotite with an average of about 2 per cent. of Ni (varies from a trace to 4·13 per cent.); cobalt is absent, or present only in traces (in one case there is 0·17 per cent.). Numerous analyses are given of various ores, waters, &c., in the report.

L. J. S.

The Wide-spread Occurrence of Barium and Strontium in Silicate Rocks. By William F. Hillebrand (*J. Amer. Chem. Soc.*, 1894, **16**, 81—82).—Attention is drawn to the fact that the detailed rock analyses made in the laboratory of the United States Geological Survey often show the presence of barium and strontium, usually below 0·1 per cent. of each, but sometimes a little more, as in some rocks from Montana and Colorado (compare next page).

L. J. S.

Banded Gabbros of Skye. By Sir Archibald Geikie and J. J. Harris Teall (*Quart. Journ. Geol. Soc.*, 1894, **50**, 645—660).—Analyses, by J. H. Player, are given of various portions of the banded gabbros of Druim an Eidhne. I is of a light coloured band mainly composed of labradorite, also with augite, uralitic hornblende, and magnetite. II, a dark band composed of augite, magnetite, and labradorite. III, a thin, ultrabasic band mainly composed of augite and magnetite. The titanium is present in the magnetite, but not as an intergrowth of ilmenite.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	FeS_2.	Mn oxide.	CaO.	MgO.
I.	52·8	0·5	17·8	1·2	4·8	—	—	12·9	4·8
II.	40·2	4·7	9·5	9·7	12·2	0·4	0·4	13·1	8·0
III.	29·5	9·2	3·8	17·8	18·2	0·4	0·3	10·0	8·7

	Na_2O.	K_2O.	Loss on ignition.	Total.	Sp. gr.
I.	3·0	0·5	1·2	99·5	2·91
II.	0·8	0·2	0·5	99·7	3·36
III.	0·2	0·1	1·0	99·2	3·87

This variation is supposed to be due to the intrusion of a heterogeneous magma.
L. J. S.

Igneous Rock of Yogo Peak, Montana. By Walter H. Weed and Louis V. Pirsson (*Amer. J. Sci.*, 1895, [3], **50**, 467—479).—The massive, granular, igneous rock of Yogo Peak, which consists mainly of augite and orthoclase, shows a progressive differentiation along the axis of the mass; at one end of the rock is a syenite (anal. I), and as the ferro-magnesian minerals and the basicity increase, it passes through the new types *yogoite* (anal. II) and *shonkinite* (anal. III). Apatite, sphene, iron ore, hornblende, oligoclase or andesine, and biotite are always present, but in varying amounts in the different types; in the syenite, there is a little quartz, and in the shonkinite a little olivine. Yogoite is defined as a rock having about equal amounts of orthoclase and augite (including other ferro-magnesian minerals), there being a predominance of orthoclase in syenite, and of augite in the shonkinite type; the last name was first given by the authors (*Bull. Geol. Soc. Amer.*, 1895, **6**, 400—422) to a rock from Square Butte, Montana (anal. IV). The extreme members of this series would be sanidinite and pyroxenite.

	SiO_2.	TiO_2.	Al_2O_3.	Cr_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	BaO.
I.	61·65	0·56	15·07	trace	2·03	2·25	0·09	3·67	4·61	0·27
II.	54·42	0·80	14·28	trace	3·32	4·13	0·10	6·12	7·72	0·32
III.	48·98	1·44	12·29	trace	2·88	5·77	0·08	9·19	9·65	0·43
IV.	46·73	0·78	10·05	—	3·53	8·20	0·28	9·68	13·22	n.d.

<table>
<tr><th></th><th>SrO.</th><th>Na_2O.</th><th>K_2O.</th><th>Li_2O.</th><th>H_2O (at 110°).</th><th>H_2O (above 110°).</th><th>P_2O_5.</th><th></th><th>Total.</th></tr>
<tr><td>I.</td><td>0·10</td><td>4·35</td><td>4·50</td><td>trace</td><td>0·26</td><td>0·41</td><td>0·33</td><td></td><td>100·15</td></tr>
<tr><td>II.</td><td>0·13</td><td>3·44</td><td>4·22</td><td>trace</td><td>0·22</td><td>0·38</td><td>0·59</td><td></td><td>100·19</td></tr>
<tr><td>III.</td><td>0·08</td><td>2·22</td><td>4·96</td><td>trace</td><td>0·26</td><td>0·56</td><td>0·98</td><td>F, 0·22</td><td>99·99</td></tr>
<tr><td>IV.</td><td>n.d.</td><td>1·81</td><td>3·76</td><td>trace</td><td colspan="2">1·24</td><td>1·51</td><td>Cl, 0·18</td><td>100·97</td></tr>
</table>

L. J. S.

Olivine-andesite of Banks Peninsula, N.Z. By R. Speight (*Trans. N.Z. Inst.*, 1893, **25**, 367—375).—This rock shows in analysis I a comparatively large silica percentage considering the large amount of olivine present; augite is present only in small quantity; sp. gr., 2·68. The porphyritic labradorite felspar gave II; sp. gr., 2·719.

	SiO_2.	Al_2O_3.	Fe_2O_3 + FeO.	CaO.	MgO.	Na_2O.	K_2O.	Loss on ignition.	Total.
I.	55·12	20·41	7·74	5·35	2·75	3·80	2·50	3·13	100·80
II.	55·3	26·3	1·8	11·4	—	5·30	trace	—	100·1

L. J. S.

Tridymite-trachyte of Lyttelton, New Zealand. By PATRICK MARSHALL (*Trans. N.Z. Inst.*, 1894, **26**, 368—387).—This rock occurs in the volcanic system of Banks Peninsula; it is of a very light colour, with large porphyritic crystals of plagioclase, and in vesicles numerous clear, glassy crystals of tridymite; ferro-magnesian minerals are rare or absent, but magnetite is abundant, and there is no interstitial glass. I and II are the extremes, as regards silica percentage, of the five analyses given; sp. gr., 2·351—2·415. Calculated from the analyses, there must be 29 per cent. of free silica, which is supposed to exist as tridymite in the ground mass; 29·95 per cent. of the rock is dissolved by boiling aqueous soda, but of this 15·05 per cent. is alumina. III gives the analysis of the felspar, which includes a narrow border of orthoclase round the plagioclase. Analysis of the associated basic and intermediate volcanic rocks are given.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	73·07	13·75	2·55	—	3·27	0·99	2·46	4·60	—	100·69
II.	71·09	15·45	1·05	0·34	3·25	0·89	2·35	4·81	0·07	99·75
III.	60·56	22·05	—	—	7·25	—	3·54	7·93	—	101·33

I and II have traces of MnO, and I trace of P_2O_5. L. J. S.

Meteorite from Moonbi, Tamworth, N.S.W. By JOHN C. H. MINGAYE (*Journ. and Proc. Roy. Soc., N.S W.*, 1893, **27**, 82—83).—This meteorite, weighing 29 lbs., gave on analysis

Fe.	Ni.	Co.	Cu.	Sn.	Cr.	C (graphite).	C (combined).
91·350	7·886	0·564	trace	0·003	trace	0·068	trace

SiO_2.	S.	P.	O.	Total.	Sp. gr.
0·039	nil	0·217	trace	100·127	7·833

L. J. S.

The Cherokee and El Capitan Meteorites. By EDWIN E. HOWELL (*Amer. J. Sci.*, 1895, [3], **50**, 252—254).—*The Cherokee meteorite* was found in 1894 near Cherokee Mills, Cherokee Co., Georgia; weight, 15½ lbs. Widmanstätten figures are strongly marked; analysis I by H. N. Stokes. The Losttown meteorite, found in 1868 in the same county, is of different appearance and composition, having only 3·36 per cent. of nickel.

	Fe.	Ni.	Co.	Cu.	Si.	P.	S.	C.	Total.
I.	91·96	6·70	0·50	0·03	trace	0·11	0·01	trace?	99·31
II.	90·51	8·40	0·60	0·05	trace	0·24	trace	—	99·80

The El Capitan meteorite was found in 1893 on the northern slope of the El Capitan range, New Mexico; weight about 61 lbs.

Analysis II by H. N. Stokes. It is suggested that this may be the "fiery ball" seen in the neighbourhood in 1882. L. J. S.

Meteorites. By Henri Moissan (*Compt. rend.*, 1895, **121**, 483—486).—Meteoric iron from Kendall Co., Texas, was found to contain amorphous carbon, but neither graphite nor diamond; a specimen from Newstead, in Scotland, contains amorphous carbon and graphite, but no diamond; one from the Sierra de Déesa, in Chili, contains a small quantity of graphite which seems to have been subjected to moderate pressure, but neither diamond nor amorphous carbon; another from Toluca-Xiquipilso, in Mexico, contains no carbon at all; the iron from Novy Urej, Krasnoslobodsk, Russia, was found to contain amorphous carbon and black diamond, as Jeroféeff and Latchinoff have already stated.

A further examination of the iron from Cañon Diablo, confirms the author's earlier statement, that this meteorite contains black diamonds, and it is the only meteorite in which the author has found amorphous carbon, graphite, and diamond together. C. H. B.

Water from Lake Corangamite, Victoria. By Andrew W. Craig and N. T. M. Wilsmore (*Australian Assoc. Adv. Sci., 4th Report*, 1893 [1892], 270—271).—Sp. gr. = 1·035; analysis gave in parts per 1000,

Ca.	Mg.	K.	Na.	SO_4.	Cl.	Br.	Total bases. as sulphates.
0·063	1·272	0·387	16·145	0·758	27·312	0·102	57·276

Hydrogen sulphide and carbonic anhydride were also present. The water was specially examined for rare alkalis, but only lithium, potassium, and sodium were found in the concentrated mother liquor. L. J. S.

Water from Nashville, Illinois, and from the Soap Lake, Washington. By George Steiger (*Bull. U.S. Geol. Survey*, 1893, No. 113, 113).—Water from the "American Carlsbad Spring," at Nashville, Illinois, contained in one million parts 4262·31 parts of solids consisting of: SiO_2, 0·29; SO_4, 39·76; CO_3, 26·80; Cl, 0·57; Al_2O_3, 0·08; Ca, 10·02; Mg, 6·51; Na, 15·97 = 100·00. Hypothetical combinations: NaCl, 0·95; Na_2SO_4, 48·15; $MgSO_4$, 9·01; $MgCO_3$, 16·47; $CaCO_3$, 25·05; Al_2O_3, 0·08; SiO_2, 0·29 = 100·00.

Water from the Soap Lake, Washington, contained in one million parts 28194·57 parts of solids consisting of: SiO_2, 0·40; SO_4, 15·47; CO_3, 34·13; Cl, 12·50; Ca, trace; Mg, 0·04; Na, 37·27; H (bicarbonate), 0·19 = 100·00. Hypothetical combinations: NaCl, 20·61; Na_2SO_4, 22·89; Na_2CO_3, 40·22; $NaHCO_3$, 15·65; $MgH_2C_2O_6$, 0·23; SiO_2, 0·40 = 100·00. The water is strongly alkaline, and contains some organic matter. L. J. S.

Analysis of Water from Ojo Caliente, New Mexico. By William F. Hillebrand (*Bull. U.S. Geol. Survey*, 1893, No. 113, 114). —A thermal spring near Taos; sp. gr. 1·00273 at 18·4°. In parts per million were found: SiO_2, 60·2; SO_4, 151·0; PO_4, 0·2; CO_3, 2153·5; B_2O_3, 4·2; Cl, 231·4; F, 5·2; Fe_2O_3, 1·6; Al_2O_3, 0·5; Ca, 22·8;

Sr, 1·4; Mg, 9·5; K, 31·4; Na, 995·1; Li, 3·4 = 3671·4. The hypothetical combinations are: LiCl, 0·62; KCl, 1·76; NaCl, 9·01; $Na_2B_4O_7$, 0·16; Na_2SO_4, 6·59; Na_2CO_3, 54·49; $Ca_3P_2O_8$, 0·01; CaF_2, 0·32; $CaCO_3$, 1·27; $SrCO_3$, 0·07; $MgCO_3$, 0·98; SiO_2, 1·78; Fe_2O_3, 0·05; Al_2O_3, 0·01; CO_2 (bicarbonate), 22·88 = 100·00. Also traces of arsenic, nitrates, iodine (?), barium, and ammonia. No organic matter, titanium, bromine, manganese, or sulphides. L. J. S.

Bituminous Mineral Waters containing Ammonia. By F. PARMENTIER (*Compt. rend.*, 1895, **121**, 644—645).—Many of the mineral waters in the neighbourhood of Clermont contain small quantities of volatile bituminous matter recognisable only by its smell and taste, and all these waters contain ammonia. The water of a spring at Grassion, from the bituminous limestone, has the following composition per litre:—Residue at 180°, 4·500; total CO_2, 4·870; Cl, 0·075; SO_3, 0·016; SiO_2, 0·050; CaO, 0·330; MgO, 0·155; K_2O, 0·026; Na_2O, 2·036; Li_2O, 0·001; Al_2O_3, 0·004; NH_3, 0·006; no traces of iron, arsenic, nitrates, or non-volatile organic matter.

Three other springs contained the following quantities of ammonia per litre:—Médecins, 0·0010; la Vallière, 0·0002; artesian well, 0·0040. The water of the spring at *Puy de la Poix* contains as much as 0·0454 gram of ammonia per litre. There is some evidence that part of the nitrogen is present in the form of organic amines.

C. H. B.

Physiological Chemistry.

Respiration in Marine Invertebrates. By HORACE M. VERNON (*J. Physiol.*, 1895, **19**, 18—70).—Observations relating to the respiratory exchanges in many of the lower marine invertebrates are described. An appendix treats of the composition of the gases and salinity of sea water.

The respiratory activity of these animals is small as compared with that of fishes. The more lowly the animal, as a rule, the greater is the increased effect produced by a rise of temperature, moreover, the respiratory activity varies inversely as the size of the animal. Captivity produced opposite effects in different animals. The respiratory quotients are higher, as a rule, than in warm-blooded animals, and generally become greater than unity on asphyxiation; in one case (*Amphioxus*) it rose to 4·45. This is probably due to the rapid onset of decomposition.

Calculated on the amount of solid in their bodies, the respiration of these lower marine animals is enormous, usually greater than in man. Thus *Cestus* and *Salpa* contain respectively only 0·24 and 0·26 per cent. of solids; other transparent animals 0·4 to 0·6; *Amphioxus* 12·8, and the fish *Heliosus*, 22·3. During captivity, pelagic animals rapidly get smaller, and the respiratory quotients, as a rule, increase. The rhythm of the *Medusa rhizostoma* is not affected by temperature to so great an extent as the respiratory activity. The rhythm rapidly decreases during activity. W. D. H.

Gas Formation in the Human Stomach. By ERNST WISSEL (*Zeit. physiol. Chem.*, 1895, **21**, 234—252).—Six cases were investigated, and very exhaustive tables are given of the analyses of the gases removed from the stomach, and also of those which formed in the stomach contents after removal. G. Hoppe-Seyler's method of analysis was employed. The fermentation and the presence of sarcinæ are by no means interdependent. The gases found were those of swallowed air, *plus* a large excess of carbonic anhydride and of hydrogen. W. D. H.

Exchange of Liquids between Blood and Tissues. By J. B. LEATHES (*J. Physiol.*, 1895, **19**, 1—14).—The conclusions to which the experiments recorded lead are: Changes in the osmotic pressure of the blood are compensated, with extreme rapidity, by the transfer of liquid from tissues to blood, or from blood to tissues, when the kidneys are excluded from the circulation. There is no evidence that the vessel walls play other than the part of a passive membrane in this interchange of liquids. They cannot be said to have the power of actively regulating the composition of the circulating blood. The osmotic pressure of the lymph from the thoracic duct is always slightly above that of the blood. This slight difference is not affected by alterations in the osmotic pressure of the blood, and is more easily accounted for by metabolism in the tissues than by any active function of the vessel walls. W. D. H.

Initial Rates of Osmosis of certain Substances in Water and in Liquids containing Albumin. By W. S. LAZARUS-BARLOW (*J. Physiol.*, 1895, **19**, 140—166).—The osmometer used, a new one, is described and figured. The conclusions arrived at are.

(1) The ratio between the initial rates of osmosis of glucose, sodium chloride, and urea in equimolecular solutions is not the same as the ratio between their final osmotic pressures, or the ratio between the differences of their freezing points and that of water. The practical bearing of this conclusion is that it is impossible to state, from a determination of their freezing points, that one solution is hypertonic, isotonic, or hypotonic as regards another solution of a different composition at pressures within the limits possible in the animal body. This can only be determined by experiment in each case.

(2) The ratio between the initial rates of osmosis of glucose, sodium chloride, and urea in equimolecular solutions differs according as the membrane is composed of peritoneum or copper ferrocyanide. The importance of the membrane as a factor has been previously insisted on by Graham and L. Meyer.

(3) In the case of the peritoneal membrane, the initial rate of osmosis of the three substances named is diminished by the presence of even small quantities of albumin.

(4) With the same membrane in watery or albuminous solutions,

the initial rate of osmosis of glucose is greater than that of sodium chloride; that of urea being the smallest. W. D. H.

Intravascular Injection of Peptone. By ERNEST H. STARLING (*J. Physiol.*, 1895, **19**, 15—17).—The present experiments do not confirm Gley's statement (*Arch. de Physiol.*, 1895, 711) that in dogs, after ligature of the portal lymphatics, the injection of "peptone" has no effect on the blood. Gley's results are explained by supposing that he dealt with an accidental aggregation of immune dogs. W. D. H.

Absorption of Iron Salts. By H. W. F. C. WOLTERING (*Zeit. physiol. Chem.*, 1895, **21**, 186—233).—In attempting a solution of this vexed question, the method adopted was to estimate the amount of iron in the liver and other organs, not in the urine, as in the work of many previous investigators. The animals used were mice, dogs, and rabbits. In some control experiments, manganese was given instead of iron, the sulphates being the salts used. Microscopic investigation showed a greater amount of iron in those animals to which iron had been given; this was confirmed by quantitative analysis. The iron of the liver is contained in part in the nucleo-proteïd of that organ. In the blood of the animals, the amount of hæmoglobin and the number of red corpuscles increases. W. D. H.

Effect of Feeding Cows with Whale and Herring Meal, especially as regards Milk Production. By JOHN SEBEBLIEN (*Landw. Versuchs-Stat.*, 1895, **46**, 259—308).—Experiments were made in which groups of 10 carefully selected cows were fed with and without whale meal. In the preliminary period (of one month), in which both groups were fed alike, the food was as follows:—Turnips (80), straw chaff (90), hay (40), rape cake meal, linseed cake meal, and malt germs (each 10 kilos.). During the next period (10th January to 1st March, 1894), whale meal was given to the second group in increasing amounts (5 to 15 kilos.), whilst the food of the first group remained much the same as in the preliminary period. During the third period of three weeks, the food of both groups was the same (without whale meal). The effect of whale meal was to raise the yield of milk by 6 per cent. or more during the period in which it was given; but there was no after effect. It made no difference whether 0·5 kilo. of whale meal was given or 1·5 kilo. (the cake being in this case reduced by 1 kilo.). The percentage of fat was not altered by the whale meal when this was given as additional food, but was lowered when an extra quantity was given in the place of cake. The absolute amount of fat was increased during the first period of whale meal feeding, but sank during the last period (with increased quantity of whale meal) to the amount produced in the preliminary period. As regards live weight, there was practically no difference in the two groups.

The results of very numerous experiments made in Denmark indicate that the composition of milk remains constant with different foods, and, in the author's experiments, very abnormal amounts of proteïn produced merely a lowering of the percentage of fat. It seems probable that the increase in fat observed when cows are turned out to grass, is due rather to the more natural way of living than to the difference in the composition of the food. The experiments with herring meal were chiefly to ascertain whether any taste was imparted to the milk and butter. The results showed that the meal had no effect either on the taste, or on the keeping qualities of the milk and butter; and the chemical examination of the butter produced from cows fed with whale meal, showed no alteration in the Wollny numbers or in the Köttstorffer numbers; and there was no depression in the iodine numbers, showing that there is no direct migration of the whale meal oil into the milk.

The evidence obtained from agriculturists as regards the taste and keeping properties of the butter is in favour of whale meal.

N. H. J. M.

Digestibility and Nutritive Value of Pumpkin Seed Cake and Buckwheat Grain. By A. Wicke and Hugo Weiske (*Landw. Versuchs-Stat.* 1895, **46**, 371—382).—Two full grown sheep were fed for three periods of 16 days with (I) hay (1 kilo.), (II) hay (900 grams), and air-dried pumpkin seed cake (100 grams), and (III) hay (800 grams), and air-dried buckwheat (200 grams) respectively. During the second eight days of each period, the fæces and urine were collected and examined. The following numbers show the percentages of the different constituents (1) of pumpkin-seed cake (sheep No. 1), and (2 and 3) of buckwheat (sheep Nos. 1 and 2), which were digested.

	Dry matter.	Organic matter.	Proteïn.	Fat.	Crude fibre.	N-free extract.	Ash.
1.	83·15	88·55	84·73	104·68	118·76	42·74	56·19
2.	74·22	74·55	79·73	92·37	40·21	77·56	62·04
3.	67·37	67·65	69·76	108·87	7·94	74·03	50·93

The high results obtained in the case of fat and crude fibre (over 100), are ascribed to the difficulties and defects of the method. The results show, however, that pumpkin seed cake is a highly digestible food, about 85 per cent. of the proteïn and the whole of the fat being digested. As regards the experiments with buckwheat, the results (2) obtained with sheep No. 1 are the more trustworthy. They show that in buckwheat all the constituents (except the crude fibre) are very digestible, in part more digestible than those of the cereals. It is possible, however, that the employment of both foods in larger quantities might give less favourable results; in the case of pumpkin seed, owing to the high percentage of fat. N. H. J. M.

Pigments of the Pieridæ. By F. Gowland Hopkins (*Proc. Roy. Soc.*, 1894, **57**, 5—6).—The wing scales of the group of butterflies known as the white Pieridæ, contain uric acid; those of the yellow Pieridæ contain, as their pigment, a yellow derivative of uric acid, which the author has obtained synthetically by heating uric acid with water in sealed tubes at high temperatures. This yellow pigment the author terms *Lepidotic acid*, and its constitution is still under investigation.

J. J. S.

Constancy of the Freezing Point of Milk and other Organic Liquids. By J. Winter (*Compt. rend.*, 1895, **121**, 696—698).—Cryometric observations show that milk and blood serum are equimolecular, and their molecular concentration is the same in all the animals examined. This seems to be true, also, of other liquids derived from animal organisms. The constancy of the freezing point of milk affords a valuable means of testing its purity; its spontaneous alterations rapidly lower the freezing point, whilst the addition of water raises it. Experiments with milk from various sources show that the values of Δ, the reduction in the freezing point, vary between 0·55 and 0·57, whilst the values for the number of gram-molecules per 100 grams of water, n, vary between 0·297 and 0·308. In a large majority of cases, including all the specimens of human milk, the value of Δ was 0·55, and that of n 0·0297. The corresponding values for blood serum from several different animals vary between exactly the same limits.

From these results, it is possible to consider the effects of various solutions on living blood, independently of the nature of the dissolved substance. If the molecular concentration of the solution is not equal to that of the serum, it will produce either a dissolution of the suspended red and white corpuscles, or a precipitation of dissolved fibrin and other constituents. It follows that the blood corpuscles and fibrin must be regarded as having the function of regulating the molecular concentration of the blood serum, just as undissolved crystals maintain a saturated solution at the point of saturation.

C. H. B.

Vernix Caseosa. By W. G. Ruppel (*Zeit. physiol. Chem.*, 1895, **21**, 122—133).—This secretion of the fœtal skin contains 35 per cent. of water, and 14 per cent. of substances soluble in ether. The remainder consists of proteïd and ash, in which calcium, magnesium, sodium, potassium, and phosphoric anhydride, but only traces of chlorine were recognised.

Attention was, however, particularly directed to the ethereal extract. In it glycerol and oleïc and palmitic acids were found, but the chief interest centres round the discovery of isocholesterol in it. In this, the secretion is similar to the fat of sheep's wool.

W. D. H.

Absence of Sugar from Normal Urine proved by a New Method. By Sir George Johnson (*Pharm. J. Trans.*, 1895, [3], **25**, 603—605).—If 4 c.c. of normal urine is placed in a test tube of about half an inch diameter, an equal volume of a saturated aqueous solution of picric acid added, and then 2 c.c. of liq. potassæ (P.B.), an orange-red colour instantly appears as a result of the incipient reducing action of creatinine at the ordinary temperature. If the liquid be heated and kept at the boiling point for about a minute, the colour deepens, and appears bright red through the test tube, held up to the light. If an aqueous solution of glucose, containing 2 grains to the ounce, be treated in like manner, the liquid will be so dark that no light will be visible across the full diameter of the tube. The solution of glucose ceases to give any coloration when it is diluted beyond 1 part in 10,000 ; but the creatinine reaction continues until the dilution reaches 1 part in 200,000. The extreme delicacy of the latter reaction affords a method of detecting a small quantity of glucose in the presence of creatinine by comparing the colorations produced by known quantities or dilutions. R. R.

Poisonous Effects of Acetylene. By NESTOR GRÉHANT (*Compt. rend.*, 1895, **121**, 564—566; by MARCELLIN BERTHELOT, *ibid.*, 566; and by HENRI MOISSAN, *ibid.*, 566).—A mixture of 20 vols. of acetylene, prepared from calcium carbide, 20·8 vols. of oxygen, and 59·2 vols. of nitrogen was breathed by a dog for 35 minutes without any marked disturbance, and 100 c.c. of the blood was found to contain 10 c.c. of acetylene. With 40 vols. of acetylene, the proportion of oxygen remaining the same, a dog died in less than an hour, owing to failure of the heart's action, and 100 c.c. of blood contained 20 c.c. of acetylene. With 79 vols. of acetylene and 21 vols. of oxygen, the poisonous effects were still more strongly marked. It follows that acetylene may be fatally poisonous when present in proportions as high as 40 per cent. by volume.

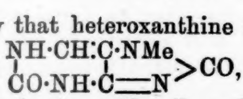
A mixture of coal gas with air and oxygen containing 20·8 per cent. of the latter and 1 per cent. of carbonic oxide was nearly fatal to a dog after it had been breathed for about 10 minutes, and 100 c.c. of the dog's blood contained 27 c.c. of carbonic oxide. It follows that acetylene is much less poisonous than ordinary coal gas.

Berthelot, in some experiments made many years ago, in conjunction with Claude Bernard, found that acetylene, when present to the extent of a few per cents. by volume, is without injurious effects on birds. The poisonous properties often attributed to this gas, as prepared by the older methods, are probably due to the presence of carbonic oxide or hydrogen cyanide.

Moissan finds that when acetylene is prepared from pure calcium carbide, and is purified by being liquefied, it has a very pleasant, ethereal odour, and can be breathed in small quantity without evil effects. If, however, the calcium carbide has been prepared from coal and impure lime, it may contain calcium sulphide and phosphide, and the acetylene prepared from it then has a very disagreeable odour.

C. H. B.

Constitution of Heteroxanthine and its Physiological Action. By MARTIN KRÜGER and GEORG SALOMON (*Zeit. physiol. Chem.*, 1895, **21**, 169—185).—From 10,000 litres of human urine, 13 grams of xanthine, 12·5 grams of paraxanthine, and 7·5 grams of heteroxanthine were obtained.

The author's experiments show that heteroxanthine is a methylxanthine, having the constitution 

$$\left.\begin{array}{l}\mathrm{NH\cdot CH{:}C\cdot NMe}\\ \mathrm{CO\cdot NH\cdot C{=\!=}N}\end{array}\right>\mathrm{CO}$$

for it yields carbonic anhydride (2 mols.), carbonic oxide (1 mol.), ammonia (3 mols.), and sarcosine (1 mol.), when hydrolysed by acids, whilst further methylation converts it into caffeïne.

On injection into frogs, the principal symptom is increased contractility of the voluntary muscles; in mammals, similar convulsions are seen. After injection, it cannot be found in the urine, and is therefore probably almost completely oxidised in the body.

W. D. H.

Derivatives of Hydrastine and Narcotine. By Edmund Falk (*Virchow's Archiv*, 1895, **142**, 360—379).—Methylhydrastamide produces, in both cold and warm-blooded animals, peripheral paralysis. In larger doses, it paralyses the heart; it dilates the vessels, lowers the blood pressure, and causes death by cessation of respiration.

Methylhydrastimide acts on the muscular tissues producing paralysis preceded by cramps; even in small doses it weakens the heart. There is dilatation of vessels, and death occurs, as in the former case.

Methylnarcotamide produces a narcotic state by acting on the cerebrum, and there is paralysis of a peripheral nature. Very large doses are necessary to affect the heart; there is fall of blood pressure. Respiration is first quickened, then becomes slower, and finally ceases.

Methylnarcotimide is a narcotic, but paralysis is incomplete and accompanied by a stage of muscular cramp; on the heart, however, its paralysing action is more marked. It is a local anæsthetic at the seat of application. There is fall of blood pressure. Respiration rises during the convulsions, but in the narcotic stage falls, and finally ceases. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Physiology of Yeast and the Importance of Selected and Pure Cultures for Wine Fermentation. By Hermann Müller (*Bied. Centr.*, 1895, **24**, 695—698; from *Jahresber. deut. schweiz. Versuchs. Stat. Wädensweil*, 1894, **3**, 73).—A comparison of the number of yeasts and fungi (given in millions per hundred grapes) on healthy and burst grapes shows an enormous increase in the latter, especially in the number of yeast-like fungi, as compared with that of wine yeast. The relation of wine yeasts to others is most favourable in dry autumns, and high-hanging grapes are better in this respect than those near the ground. The different wine yeasts vary very much in activity. Rapid production of violent fermentation forms the best means of suppressing injurious fungi and bacteria, both by quickly utilising the oxygen present in the liquid and replacing the air by carbonic anhydride, and also by the poisonous action of carbonic anhydride on many fungi. Too violent fermentation may be disadvantageous, by causing frothing over, and especially by producing too high a temperature. Frothing is produced by the yeast rising to the surface and by the separation of fine particles from the liquid, which subsequently float and form a thin layer.

A number of yeasts from various wine districts were examined as regards their power of fermenting sugar.

The bouquet of wines is produced by fermentation from substances in the grape juice which possess no odour. Apart from the bouquet, the yeasts produce tastes and odours peculiar to themselves (just as

Penicillium causes the characteristic mouldy odour), which, of course, alter the bouquet more or less.

In cultivating the yeasts, fresh, sterilised grape-must is most suitable, currant, apple, and pear must are less, and artificial solutions still less suitable. Addition of ammonium chloride increases the production.

By means of pure cultivations of yeast, the process of wine-making is shortened, the taste and odour are decidedly purer and free from faults; the wine will also keep better. Cider, so made, has a greater resemblance to wine from grapes. The general employment of pure cultivations is only a matter of time. N. H. J. M.

The Sugar that forms in the Auto-digestion of Yeast. By Ernst L. Salkowski (*Zeit. Biol.*, 1895, **32**, 468—472).—M. Cremer suggests that the sugar which the present author previously described as formed on the auto-digestion of yeast, and as being lævorotatory, does not exist, but that peptone accounts for the rotation.

Renewed experiments show that no peptone or proteose is present, and that the leucine found will only account for a small part of the rotation. The identification of the sugar is not, however, yet effected.
W. D. H.

Measurement of the Reducing Power of Pure Yeasts. By Nastukoff (*Compt. rend.*, 1895, **121**, 535—536).—The author measures the reducing power of yeasts by the degree of blackening produced in a 10 per cent. solution of cane sugar, to which has been added 5 grams per litre of Gastine's saline mixture (*Compt. rend.*, 1889, **109**, 479), the calcium sulphate being replaced by magnesium sulphate and some basic bismuth nitrate being added. The same race of yeast gives practically constant results, but different races show different reducing powers. Comparison of the degree of darkening with the quantity of alcohol produced, or of carbonic anhydride evolved, shows that these two forms of protoplasmic activity have no direct connection.

The liquid containing the bismuth may be placed in a tube immersed in a liquid containing no bismuth, but otherwise similar in composition, the two being separated by goldbeater's skin and mixing only by diffusion. Instead of measuring the darkening of the bismuth solution, advantage may be taken of the fact that the sulphide gives a yellow tint with the nitrites that are formed simultaneously, that this coloration is not affected by boiling, and that its intensity can be measured.

The five yeasts examined, showed reducing powers in the following order, the most powerful reducer being placed first: (1) wine yeast from Champagne; (2) wine yeast from Portugal; (3) *Saccharomyces pastorianus*; (4) *Saccharomyces apiculatus*; (5) beer yeast from Brussels. C. H. B.

Fermentation of Cellulose. By V. Omelianski (*Compt. rend.*, 1895, **121**, 653—655).—*Bacillus amylobacter*, which has hitherto been regarded as the special ferment of cellulose, is really a collective species, including a large number of different butyric ferments. None of these has, so far, shown any marked power of decomposing pure cellulose. The special microbe of cellulose fermentation can be isolated by the method of elective cultures. Swedish filter paper and chalk are placed in a solution of potassium phosphate, magnesium sulphate, and ammonium sulphate, with a trace of ooze of the Néva. The flasks are hermetically closed and kept at 30—35°; fermentation is somewhat rapid, and the paper becomes yellowish, transparent, and gelatinous, and finally dissolves, some of the chalk dissolving at the same time. The ferment is found on the paper, and not in the liquid; it is very thin, 6 to 7 μ long, and 0·2—0·3 μ broad, and forms very round spores, 1 μ in diameter. Further cultivations on potato are necessary, in order to obtain the bacillus quite pure. C. H. B.

Ethylic Alcohol from the Fermentation of Asphodelus ramosus and Scilla maritima. By G. Rivière and Bailhache (*Compt. rend.*, 1895, **121**, 659—662).—The tuberous roots of *Asphodelus ramosus*, which grows abundantly in the wild state in Algeria, were cut up and extracted with warm water by diffusion. The solution was boiled, allowed to cool, mixed with 2 per cent. of lime, allowed to remain for 48 hours, filtered, and the excess of calcium precipitated with sulphuric acid; after removal of the calcium sulphate, the "solution" was limpid, and slightly amber coloured. The exhausted cossettes were pulped, mixed with 2 per cent. of sulphuric acid, boiled in order to completely saccharify the starches, filtered, mixed with lime in quantity sufficient to leave an excess of 2 per cent., and allowed to remain for 48 hours. It was then filtered, neutralised with sulphuric acid, and, after separation of the calcium sulphate, mixed with the solution obtained in the first stage.

The mixed solutions were sterilised by successive ebullitions with two days' interval, cooled, and mixed with pure yeast from the white wine of Burgundy. Fermentation begins almost immediately, and is complete in four or five days, distillation yielding a liquid with an alcoholic strength of 50° to 55°. The alcohol has the agreeable bouquet due to the yeast, and is free from the disagreeable odour that has hitherto characterised alcohol from the asphodel.

Scilla maritima, which also grows abundantly in the wild state in Algeria, when treated in a similar manner, yields an alcohol resembling wine brandy, and with the bouquet characteristic of the particular yeast.

The alcohol from *Scilla* has a flavour somewhat inferior to that of the alcohol from *Asphodelus*, and contains a higher proportion of aldehyde. Both, however, are free from furfuraldehyde, and contain only slight traces of higher alcohols. C. H. B.

Assimilation of Elementary Nitrogen by Plants. By Julius Stoklasa (*Landw. Jahrb.*, 1895, **24**, 827—863).—The results of observations made with lupins (*Lupinus angustifolius*) grown in a field, indicated that the plants without nodules grew as well as those with nodules. The soil was a poor, loamy sand (nitrogen = 0·023 per cent.). The total nitrogen of both plants was practically the same, but (at the flowering period) was differently distributed. In the plants without nodules, there was more nitrogen in the stems and leaves; in those with nodules, the roots were richer in nitrogen than the roots without nodules. The average weight of the nodules was 0·74 gram when fresh, 0·117 gram when dry, and the dry matter contained 4·5 per cent. of nitrogen.

Four series of pot experiments were made, in which lupins were grown: (1) in ignited sand, maintained in a state of sterilisation; (2) in the same sand, with the addition of a few grams of lupin soil; (3) in sandy soil (N = 0·0065 per cent.); and (4) in the sandy soil, microbe seeded with lupin soil. There were 12 or 16 pots (each with one plant) in each series, but in the following table the results of 10 pots are taken together in each case. The nitrogen supplied includes in each case (1) the nitrogen of the 10 seeds sown (0·069 gram), (2) nitrogen as ammonia (0·099 gram), and as nitrates (0·100 gram), supposed to have been possibly absorbed from the air, and (3) the nitrogen of the lupin soil added (= 0·152 gram) to the 10 pots.

	Dry produce (10 plants).	Nitrogen.		
		Supplied.	In produce.	Gain.
1. Ignited sand sterilised....	27·86	0·268	0·459	0·191
2. „ „ inoculated ..	64·85	0·420	1·995	1·575
3. Sandy soil not sterilised ..	66·40	0·268	2·394	2·126
4. „ „ inoculated....	63·85	0·420	2·510	2·090

In series (1) there was thus some fixation under conditions of sterilisation, and without nodule formation, that is, without symbiosis, whilst in series (2), in which well formed nodules were produced, fixation was much increased. In series (3) the surface of the soil was covered with algæ; incompletely developed nodules were found on the roots of four plants; but in the above table only plants free from nodules are included. In series (4), in which a number of well formed nodules were produced, there was rather less fixation than in series (3).

As regards the nitrogen of the sandy soil of series (3) and (4), the percentage increased from 0·0065 at the commencement to 0·0098 in series (3), and 0·0104 in series (4) at the conclusion, whilst the total soil nitrogen in each pot (14 kilos. of sand) rose from 0·91 gram to 1·372 and 1·456 gram respectively; there was thus a gain of nitrogen due to the bacteria and algæ. The results show that under conditions of sterilisation, nitrogen assimilation is very feeble, whilst soil inoculation increases it eight fold. In non-sterilised soil, in which algæ and bacteria increase the nitrogen required for the first development of the plants, lupins without nodules assimilate nitrogen to the same extent as lupins with nodules.

An examination of the nodules of *Lupinus luteus* showed that they contained no ammonia, and only traces of nitric acid, the latter disappearing at the period of ripeness. The percentage of total nitrogen in the dry matter of roots and nodules at (1) the flowering period, (2) the period of fruit formation, and (3) at the period of complete ripeness are given below; also the percentage of nitrogen as proteïds, amides, and asparagine in the nodules at the first and third periods.

Period.	Nitrogen in roots.	Nitrogen in nodules.			
		Total.	As proteïds.	As amides.	As asparagine.
1	1·64	5·22	3·99	0·35	0·34
2	1·84	2·61	—	—	—
3	1·42	1·73	1·54	0·15	traces

The pure ash of the roots (4·55 per cent.), and the nodules (6·32 per cent.) had the percentage composition.

	K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3.	P_2O_5.	SO_3.	SiO_2.
Roots..	14·52	26·88	16·87	11·73	1·08	9·82	15·84	3·59
Nodules	20·86	22·74	10·71	12·35	1·19	14·94	12·25	3·01

In order to ascertain whether the absence of light has any effect on the nodules as well as on the leaves, a number of well-developed, flowering lupin plants were kept in the dark for 13 days; by this time the plants had become yellow, and were taken up along with similar plants, kept under ordinary conditions, and examined. The results are given in percentages of the dry substances of (1) leaves and nodules of normal plants, and (2) of the plants kept in the dark.

	Leaves.				Nodules.			
	Nitrogen.		Asparagine.	Lecithin.	Nitrogen.		Asparagine.	Lecithin.
	Total.	Proteïn.			Total.	Proteïn.		
1 ..	3·29	2·87	0·49	1·24	4·99	3·96	1·37	1·12
2 ..	3·47	1·80	4·19	0·68	3·11	1·47	4·98	0·53

The average weight of the single nodules was (1) 0·1184, (2) 0·0806 gram.

The results of these experiments confirm the view generally held regarding the production of asparagine in plants in absence of light, not only in the leaves but also in the root nodules; they also show that in the nodules the living plasma with the bacteria does not support independent processes of nitrogen assimilation.

The following amounts of oxalic acid and hexoses (reckoned as glucose) were found in the dry nodules.

	Oxalic acid.	Hexoses.
Nodules of the normal plants	2·06	6·33
„ of the plants kept dark ...	1·06	5·89

It is concluded that assimilation takes place in the leaves, and that the amides migrate from the leaves to the root nodules, where they interact with glucose to produce proteïds, these forming the nutritive medium for bacteria.

Experiments were made on nitrogen fixation by a non-leguminous plant—buckwheat. The plants were grown in iron vessels holding 14 kilograms each; five seeds were sown in each pot. There were four series, each comprising eight (or four) pots, as follows:—(1) Ignited sand, with minerals; (2) sandy soil (N = 0·0065 per cent.), not sterilised; (3 and 4) same as (1) and (2) respectively, with addition of ammonium nitrate (0·5 gram to each pot). The following results were obtained.

No. of series.	Number of plants.	Dry produce.	Nitrogen.			
			In seeds sown.	As $NH_4 \cdot NO_3$ added.	In produce.	Gain.
1	37	3·04	0·0176	—	0·0712	0·0536
2	40	20·43	0·0190	—	0·603	0·5840
3	16	41·24	0·0076	0·7	1·258	0·5504
4	16	58·56	0·0076	0·7	1·816	1·1084

The average gain of nitrogen in these, and a number of similar experiments made from 1890 to 1894, was (1) 0·138, (2) 1·378, (3) 3·385, and (4) 6·09 grams for 100 plants. The gain in the soil itself was in series (2) from 0·0065 to 0·020; series (4) to 0·039 per cent. There was about the same gain in similar soil kept without vegetation. In series (1) and (3), a trace of nitrogen was found in the sand at the end of the experiment.

The results obtained with series (1) indicate a gain of nitrogen under conditions of sterilisation, but in such small quantity that it may have been derived from the combined nitrogen of the air. In series (2), the results obtained with the plants and with soils free from vegetation show that the plants must have fixed free nitrogen. In sterilised sandy soil, series (3), with ammonium nitrate, the assimilation was greatly increased, whilst in series (4) there was over forty times as much nitrogen assimilated (by the plants) as in sterilised sand.

Further experiments were made in which buckwheat was grown in the ignited sand, to which sterilised horn meal was added (so as to make the percentage of nitrogen correspond with that of the soil) as well as 0·5 gram of ammonium nitrate. The gain of nitrogen in the plants was practically the same as that already obtained in series (3). It is, therefore, seen that in sterilised soil containing an excess of nitrogenous food, the plant never develops as well as in non-sterilised soil, in presence of algæ and bacteria.

It is concluded that nitrogen fixation by buckwheat increases with the development of the leaves and roots; that in sterilised soil and without combined nitrogen there will be no considerable fixation; that in presence of nitrates in excess, if under conditions of sterilisation, nitrogen assimilation never reaches the maximum, as compared with plants grown in non-sterilised soils, and that Hellriegel's theory of nitrogen fixation by Leguminosæ alone in symbiosis is wrong. Whilst agreeing with Frank, that free nitrogen is assimilated by the living protoplasma of the cells of green leaves and roots, the author maintains that the bacteria of the soil play a very essential part in the process. N. H. J. M.

The Mineral Food of Lower Fungi. By HANS MOLISCH (*Bied. Centr.*, 1895, **24**, 635; from *Bot. Centr.*, 1894, 167).—Iron is necessary for fungi, and cannot be replaced by manganese, cobalt, or nickel. In opposition to Nägeli, it is stated that magnesium is indispensable, and cannot be replaced by metals of the alkaline earths or of the zinc group (Zn, Be, Cd), cadmium being poisonous even in very dilute solutions. Calcium is not necessary for the lower fungi (or, as has recently been shown, for algæ); this is the one remarkable difference as regards the requirements of fungi as compared with the higher plants; the other nine elements (C, H, O, N, S, P, K, Mg, Fe) being equally necessary for both. N. H. J. H.

Physiological Studies on Hops. By J. BEHRENS (*Bied. Centr.*, 1895, **24**, 635; from *Bot. Centr.*, 1894, 178).—The rhizome differs from the above-ground sprouts in colour, absence of leaves, and also in being much thicker, its fleshy consistence indicating its character as reservoir. It is produced only by external influences. The percentage composition of the dry rhizome branches (free from sand), cut in the spring, is as follows.

N.	Proteïds.	Non-proteïn (as asparagine).	Directly reducing sugar.	Invert sugar (as cane).	Ether extract.	Ash.
3·46	14·28	5·57	9·62	8·58	2·08	7·08

N. H. J. M.

Formation of Indigo in Plants of the Order Indigofera. By C. J. VAN LOOKEREN and P. J. VAN DER VEEN (*Landw. Versuchs-Stat.*, 1895, **46**, 249—258; compare Abstr., 1895, i, 96).—The extract of the leaves of the indigofera shows an alkaline reaction with litmus and with rosolic acid, an acid reaction with phenolphthaleïn. When the leaves are "fermented" with dilute (0·5 to 1 per cent.) acids, solutions are obtained which yield indigo under the influence of atmospheric oxygen and behave similarly to the solutions obtained by reducing ordinary indigo, precipitating with dilute acid, extracting with chloroform, and taking up the residue with water. Such a solution cannot be obtained from pure indigotin.

Indigotin-white, together with indirubin-white, and other products formed from indican under the influence of enzymes in absence of air, behave differently, as regards solubility in water and chloroform and in the readiness with which they are oxidised, from indigo-white, either in the pure state or mixed with indifferent substances. Indigo-blue containing so-called "indigo-brown" is slightly soluble in presence of free alkali, whilst if indigo-red is present it is also soluble in alcohol; this explains why acid extracts contain indigo-white in solution. N. H. J. M.

Occurrence of Carotene. By SCHRÖTTER-KRISTELLI (*Bied. Centr.*, 1895, **24**, 709—710; from *Bot. Centr.*, 1895, **61**, 33).—The yellow dye was found dissolved in oil, in the outer cell layers of the seed covering of *Afzelia Cuanzensis.* The yellow, yellowish-red, and vermilion dyes, known under various names, which occur in plants and animals, mostly belong to a homologous series for which the name *lipoxanthin* series is proposed. The dyes are always united to fatty substances, are insoluble in water, are not fluorescent, give a blue colour when treated with sulphuric acid, absorb the violet rays of the spectrum, and are readily decomposed by light and heat.

In plants, an entirely different group of yellow dyes occurs. These are dissolved in the sap, and give a red or brown colour with sulphuric acid.

The lipoxanthin colours are terpene-like substances, which absorb oxygen without being destroyed as long as the protoplasm has sufficient vigour. It is probable that by continued reducing action, cholesterol yields yellow, and finally green, colouring matters (chlorophyll); whilst, by oxidation, chlorophyll would yield yellow dyes, and finally cholesterol. N. H. J. M.

The Nitrogenous Constituents of Young Green Plants of Vicia Sativa. By ERNST SCHULZE (*Landw. Versuchs.-Stat.*, 1895, **46**, 383—397).—In the course of an investigation on the composition of etiolated seedlings of the vetch, *Vicia sativa*, as compared with normal green plants, Prianischnikow (Abstr., 1895, ii, 124) identified asparagine with certainty, whilst the other compounds were not obtained in sufficient quantity for separation. The author has now succeeded in identifying leucin in six-weeks old plants. Amidovaleric acid and phenylalanin, which occur along with leucine in etiolated seedlings, could not be detected in the green plants. As regards organic bases, both betaïne and choline were separated, whilst the results of both the author's and Prianischnikow's experiments make it probable that guanidine is present in small amount.

In nine-weeks old plants, asparagine and xanthine substances (nucleïn bases) were found, but not vernin; betaïne and a very small quantity of a base which seemed to be choline were also found.

Betaïne seems not to belong to those constituents of seeds which are consumed during germination. Choline occurs in etoliated plants in greater amount than in the ungerminated seeds, and is probably produced in the decomposition of lecithin in absence of light. Guanidine is doubtless present in much smaller quantity in green than in etiolated plants. N. H. J. M.

The Seeds of Nephelium Lappaceum and the Fats contained therein. By MAX BACZEWSKI (*Monatsh.*, 1895, **16**, 866—880). —The percentage composition of the ground seed of *Nephelium lappaceum* is as follows. Water, 5·87; fat, soluble in ether and petroleum, 35·07; ether extractive matter, insoluble in petroleum, 3·00; ash, 1·95; albumin, 8·89; crude fibre, 6·90; starch, 25·63; sugar, 1·25. The fats consist of the triglycerides of arachic and oleïc acids, together with a very small quantity of the triglyceride of stearic acid. G. T. M.

Chemical Composition of Capsicum. By BÉLA VON BITTÓ (*Landw. Versuchs-Stat.*, 1895, **46**, 309—327; compare Abstr., 1893, ii, 546).—The oil extracted by ether from the seeds of capsicum becomes green when kept in a vacuum over sulphuric acid. Its sp. gr. = 0·91095 at 15°; iodine number, 119·5; Köttsdorfer number = 187·2. It contains C = 76·35, H = 11·35 per cent. The mean of two determinations of free fatty acids (mainly palmitic, with some stearic and oleïc acids) in the oil was 2·75 per cent., or 0·64 and 0·70 per cent. in the fresh and dried seeds respectively. The glycerides calculated as oleïn (which was the chief constituent) amounted to 24·06 per cent. in the dry seeds. When the oil is long exposed to air, an intense green colour is produced owing to the presence of a small quantity of chlorophyll.

In separating the free fatty acids from the glycerides by extracting once or twice with light petroleum, it was noticed that the acids had a sharp, burning taste, due to the presence of an active substance which was separated in small quantity. This forms white crystals, very readily soluble in chloroform and ether, rather soluble in light petroleum, sparingly soluble in absolute alcohol, and insoluble in water. It has an acid reaction, dissolves in alkaline solutions, but is precipitated by carbonic anhydride. It has an extremely burning taste, and when heated, gives off vapours which violently attack the mucous membrane.

The average amount of lecithin in the dried seeds was found to be 1·82 per cent., when determined directly by Schulze and Steiger's method.

Fresh analyses of the seeds were made, as before, by Henneberg's method, but the results do not differ much from those previously obtained (*loc. cit.*), except in the case of the nitrogeen-free extract (29·64) and the crude fibre (21·23 per cent. on dry matter). The crude fibre was redetermined by Schulze's method (*Landw. Versuchs.-Stat.*, **39**, 283); the average result was 30·50 per cent. The nitrogen-free extract then amounts to 20·19 per cent., consisting in part only of carbohydrates. There seems to be only a trace of a true carbohydrate (either dextrose or a substance which, when hydrolysed, gives dextrose); pentoses are present in greater amount, whilst galactose, mannose, starch, and cane sugar, &c., could not be detected.

By means of 1·5 per cent. aqueous potash, a new carbohydrate, termed *capsicum seed mucilage*, was extracted from the seeds. It is insoluble in water, merely swelling. With iodine, a green coloration is produced which rapidly becomes blue. Zinc chloride and potassium iodide give no reaction. After boiling with acids, it readily reduces Fehling's solution. It contains pentose and probably galactose groups.

New analyses of the placenta are given, and also the averages of these and the earlier results (*loc. cit.*). The pure ash of the placenta has the following percentage composition.

K_2O.	Na_2O.	CaO.	MgO.	Fe_2O_3.	P_2O_5.	SO_3.	SiO_2.	Cl.
66·06	4·44	4·70	3·97	0·88	8·75	8·32	3·72	2·89

Alumina and manganese were found in traces in the ash.

N. H. J. M.

Constituents of the Tissues of Fungi. By ERNST WINTERSTEIN (*Zeit. physiol. Chem.*, 1895, **21**, 134—151; compare Abstr., 1894, ii, 425; 1895, i, 80, 199, 323, and 493; also Gilson, Abstr., 1895, i, 323, ii, 323 and 408).—This paper is mainly a *résumé* of work published elsewhere. J. J. S.

Constituents of the Cell Membranes of various Cryptogams. By ERNST WINTERSTEIN (*Zeit. physiol. Chem.*, 1895, **21**, 152—154; compare Schulze, Abstr., 1894, ii, 250).—For his investigation, the author has used two species of fern, *Aspidium filix mas.* and *Asplenium filix fem.*, and several species of moss belonging to the *Bryaceæ* family. Cellulose preparations were made from the cell membranes, and then the products obtained by hydrolysis with sulphuric acid were investigated; from each preparation a syrup was obtained, which consisted mainly of *d*-glucose mixed with a small quantity of mannose. J. J. S.

Proteïds of Cotton Seeds. By THOMAS B. OSBORNE and CLARK G. VOORHEES (*J. Amer. Chem. Soc.*, 1894, **16**, 778—785).—This is mainly an account of preliminary experiments. The oil-free cotton seed meal was first extracted with water, and the solution, after dialysis, yielded 0·75 per cent. of proteose-like matter. When further extracted with 10—20 per cent. solution of common salt, the meal yielded a larger amount of globulin (15·83 per cent.), which in properties and composition is remarkably similar to the vegetable vitellin of flax, hemp, &c.; no other globulins soluble in sodium chloride solution could be isolated. The authors term the globulin which is soluble in salt "*edestin*," since it occurs in so many important food stuffs. The meal was further treated with aqueous potash, and yielded other proteïd matter, which, however, could not be obtained in a pure state. The residue, after treatment with potash, also contains a notable quantity of nitrogen. J. J. S.

Injury to Plants by Nitrogen acids. By F. JOSEF KÖNIG and EMIL HASELHOFF (*Bied. Centr.*, 1895, **24**, 610—611; from *Landw. Jahrb.*, 1894, **23**, 1031).—Experiments made on young trees showed that 1 part of hyponitrous acid (calculated as N_2O_4) in 20,000 parts of air (or 0·05 gram in 1 cubic metre) is injurious. As air contains 0·00003 gram of nitrous acid per cubic metre, the air to be injurious must contain 2,000 times as much as is generally present. The limit within which nitrogen acids become injurious is between those of hydrogen chloride (1 : 15,000 vol. according to Christel) and sulphurous acid (1 : 54,000 vol. according to Freitag).

The effects produced on leaves by nitrogen acids are similar to those of sulphurous and hydrochloric acids—brown or yellow spots or edges.
N. H. J. M.

Effect of Strychnine on Plant Development. By R. Otto (*Bied. Centr.*, 1895, **24**, 711; from *Naturw. Wochenschr.*, 1894, No. 51, 625).—The addition of strychnine phosphate to four weeks old beans, grown in sand and in humus soil respectively, greatly retarded the growth of the plants growing in sand. The plants flowered, but did not produce normal fruit. In soil, the plants were slightly retarded, had an almost normal colour, and produced a quantity of normal fruit. More than 10·5 grams of strychnine salt was added to 2 kilograms of soil during the eight weeks the experiment lasted. On extracting the soils with water, no strychnine was found, the poison having been destroyed by the soil. In soils which were saturated with a solution of strychnine from the commencement, the germination of beans was considerably delayed; two plants in soil, however, developed comparatively normally, whilst those in sand decayed.
N. H. J. M.

Black Siberian Lupins. By Bernhard Schulze (*Bied. Centr.*, 1895, **24**, 614—615; from *D. Landwir*, 1895, No. 30, 175).—Black lupins are said to be unusually poor in alkaloïds, so that it is not necessary to destroy the alkaloïds before feeding. A number of samples of imported black lupins were found to contain in nearly every case more alkaloïds than are found in the native yellow, white and blue lupins, and complete analyses of black and yellow lupins, the results of which are given, show that the black are not better than the German varieties either as regards nutritive qualities or amount of alkaloïds. Black lupins are very rich in alkaloïds, and probably contain the poison which causes the disease known as lupinose.
N. H. J. M.

Effect of Different Manures on the Composition and Combustibility of Tobacco. By Harry J. Patterson (*Bied. Centr.*, 1895, **24**, 662—663; from *Agric. Science*, 1894, **8**, 329).—The experiments were made in five of the chief tobacco growing districts of Maryland. The amount of total ash depends chiefly on the soil, and only slightly on manuring, but it was found that potassium chloride raised the percentage of ash most. The amounts of lime and magnesia are influenced by manuring, but still more by the character of the soil, whilst the amount of chlorine is more influenced by manuring.

Tobacco which burns well generally contains much sand and silica; the combustibility increases with the amount of lime and magnesia, but there seems to be no relation between combustibility and amount of phosphoric acid or of crude fibre. The quality of tobacco is largely influenced by the character of the previous growth. In Maryland, land growing pines is found most suitable; chestnut land comes next, whilst land on which oaks and hickory are growing is unsuitable for tobacco, and is planted first with *Andropogon virginicum*, followed by pines. The effect of these plants on the cultivation of tobacco is explained by its requirements as regards potash and chlorine. The relation between chlorine and potash in the red pine is 1 : 1·3, in *Andropogon* 1 : 2·5, in chestnut 1 : 14·4, in oak 1 : 50·0, and in hickory 1 : 63·0. The beneficial plants withdraw much chlorine from the soil, the others much potash. N. H. J. M.

Composition of Rice imported into France. By BALLAND (*Compt. rend.*, 1895, **121**, 561—564).—Decorticated rice from the principal localities (Burmah, Carolina, India, Japan, Java, Piedmont, Saigon [Cochin China]) shows percentage compositions varying between the extremes quoted below.

	Water.	Nitrogenous matter.	Fat.	Amyloïds.	Cellulose.	Ash.
Maximum....	16·00	8·82	0·75	81·35	0·42	0·58
Minimum....	10·20	5·50	0·15	75·60	0·18	0·42

Crude rice contains a higher proportion of nitrogenous and fatty substances and ash, the limits being as follows.

	Water.	Nitrogenous matter.	Fat.	Amyloïds.	Cellulose.	Ash.
Minimum....	11·20	6·18	1·85	73·85	0·93	1·20
Maximum....	13·30	9·05	2·50	75·60	2·38	2·20

In refined rice, the acidity lies between 0·032 and 0·062, and the sugar between 0·15 and 0·50, the values in the case of crude rice being 0·043—0·087 and 0·56—0·90 respectively. There is no connection between the size of the grains and the proportion of nitrogenous matter. Rice has more value as a food than is commonly supposed. The Cochin China rice, although the grains are small, contains as much nitrogenous matter and phosphatic ash as some wheats, and rather more fat. The process of decorticating, especially by machinery, greatly reduces the proportion of fat, nitrogenous matter, and ash, and the loss is still higher if the grains are polished.

C. H. B.

Are Nitrates indispensable for the Growth of Plants? By OTTO PITSCH and J. VAN HAARST (*Landw. Versuchs-Stat.*, 1895, **46**, 357—370; compare Abstr., 1893, ii, 385).—The experiments now described were similar to the earlier ones; the nitrifying bacteria were destroyed, and the nitrates present in the soil extracted with water. In 1892, wheat was grown in soil containing 0·105 per cent. of nitrogen, and in the same soil, with addition of ammonium sulphate (corresponding with 1·05 gram and 0·53 gram of nitrogen) and of sodium nitrate (1·05 gram of nitrogen) respectively. The total yield (grains and straw) with the larger amount of ammonium sulphate was less than where no nitrogen was applied; with the smaller amount of ammonium salt, the yield was about the same as without any application, whilst with nitrate, the yield was largely increased. In 1893, experiments were made with oats. The application of nitrates again gave a much higher yield than the ammonium salts. The application of both potassium and sodium chlorides in conjunction with ammonium salts resulted in a considerably increased production of dry matter as compared with that obtained under the influence of ammonium salts alone; moreover, the yield was practically the same with the larger and smaller amounts of ammonium salts, whereas without the chlorides, considerably less total produce was obtained with the larger than with the smaller amount of ammonium salt. Similar results were obtained (again with oats) in 1893. The question how the sodium and potassium chlorides act has not been studied, but results obtained by Pagnoul (Abstr., 1895, ii, 130) indicate some interaction in the soil beneficial to the plants.

N. H. J. M.

Assimilation of the Nutritive Matters of the Soil by Plants. By F. Josef König and Emil Haselhoff (*Bied. Centr.*, 1895, **24**, 687—691; from *Landw. Jahrb.*, 1894, **23**, 1009).—Two artificial soils were made, in which the constituents were partly in a physically combined (absorbed), and partly in a chemically combined, state. The percentage composition was as follows.

	Sand.	Clay.	Humus.	$Fe_2(HO)_6$.	$Al_2(HO)_6$.	$Si(HO)_4$.	Zeolite.
A.	84·1	10·0	2·5	2·5	0·7	0·2	0·0
B.	82·0	10·0	2·5	3·0	0·3	0·2	2·0

The absorptive powers of the two mixtures were tested by Zalomanoff and Pillitz's process, with nutritive solutions of different strengths. In the case of mixture A, a greater absolute as well as percentage amount was absorbed from stronger than from weaker solutions. In the second mixture B, the absorptive power for lime, magnesia, and potash was increased by the presence of zeolite, and the double strength of the nutritive solution caused greater absorption only in the case of lime. Generally $\frac{1}{7}$ to $\frac{1}{4}$ of the lime, 0 to $\frac{1}{3}$ of the magnesia, and $\frac{1}{5}$ to $\frac{1}{2}$ the potash applied were absorbed. Soda and sulphuric acid were only absorbed in traces, whilst the phosphoric acid was completely absorbed.

Vegetation experiments were made, in which barley followed by horse beans were grown in the artificial soils, with and without application of further nutritive matter. The nutritive substances were applied (1) entirely in a soluble form (2, 3, and 4) in both soluble and insoluble form in varying proportions, and (5) in an insoluble form. It was found that whilst the gramineous plant (barley) gave a yield in nearly direct relation to the amount of soluble nutritive matter applied, the yield of leguminous plant (horse bean) was rather in relation to the total amount of nutritive matter than amount of soluble matter. Lime seems to influence the growth of leguminous plants more than potash under otherwise similar nutritive conditions.

The actual amounts of nutritive matter in the soluble and insoluble forms which were taken up by the plants are given in tables.

N. H. J. M.

Composition of Native and Cultivated Soils. Effect of Continuous Cultivation on their Fertility. By HARRY SNYDER (*Minnesota Stat. Bull.*, 1893, No. 30).—Analysis of about 150 Minnesota soils, both cultivated and uncultivated, were made, the surface soils being sampled to a depth of about 9 inches, or until a change of colour was noticed. The most important soils are the deep black soils of the Red River Valley, containing 0·35 to 0·4 per cent. of nitrogen which, by continuous cultivation for 12 or 15 years, has been reduced to 0·2—0·3 per cent. Small spots of alkali soils sometimes occur; these are most benefited by deep ploughing, drainage, and the application of stable manure. "Gumbo" soils are heavy soils consisting of very fine particles less than 0·01 inch in size, and free from true sand. They are rich in potash.

By the continuous, exclusive growth of grain crops for 10—15 years, the amount of humus in the soil is reduced to one-third or one-half, the soil, from loss of organic matter, losing its power of retaining water, and thus becoming subject to drying out.

Soils rich in humus contain more available phosphoric acid than poor soils, and produce more carbonic anhydride, which acts as a solvent on the mineral matter, and thus aids the roots in taking up food. In order to keep up the supply of organic matter in the soil, a system of rotation and application of stable manure is recommended. Artificial manures will then be unnecessary. In some cases where, for instance, the surface soil is rich in nitrogen and phosphates, the corresponding subsoil rich in potash and lime, the good qualities of both surface and subsoil would be utilised by a rotation of crops.

N. H. J. M.

Citrate Solubility of the Phosphoric acid of Basic Slag. By WILHELM HOFFMEISTER (*Landw. Versuchs-Stat.*, 1895, **46**, 399—405).—The results of the experiments described indicate that the citrate solubility of the phosphoric acid depends on the amount of lime and silica present, and on the fineness, both as regards the total amount of fine meal, and also the degree of fineness.

Fineness is rendered more easy to obtain mechanically by the presence of large amounts of lime and silica. The value of basic slag depends essentially on the greater or less possibility of the production of tetrabasic calcium phosphate in the fused substance, and on its fineness. N. H. J. M.

Phosphate Manuring. By VON LIEBENBERG (*Bied. Centr.*, 1895, **24**, 663—664; from *Mitteil. Ver. Förd. Versuchwesens Oesterreich*, 1894, **9**, 125—128).—The object of the experiments, which will be continued for some years, is to ascertain whether yearly applications of soluble phosphates may with advantage be substituted by one very heavy application of a cheap, but sparingly soluble phosphate. The dry surface and subsoil contained respectively $N = 0·1166$ and $0·0969$; $P_2O_5 = 0·188$ and $0·183$; $K_2O = 0·364$ and $0·423$; $CaCO_3 = 3·139$ and $2·239$ per cent. Two plots of 100 square metres were manured as follows:—(1) No manure; (2) sodium nitrate, 200 kilos.; (3) same as (2), with soluble phosphoric acid, 50 kilos., as Spodium superphosphate (4) same as (2), with phosphoric acid, 500 kilos., as Redonda phosphate. The crop was winter rye. The application of nitrate alone gave a very satisfactory increase, whilst phosphoric acid in both forms gave a still greater increase. The superphosphate gave rather more straw and less grain than the Redonda phosphate; but, on the whole, the effect of both manures may be considered equal.

N. H. J. M.

Pigeon Manure. By BERNHARD SCHULZE (*Bied. Centr.*, 1895, **24**, 590—591; from *Der Landwirt*, 1895, No. 51, 301).—The value of pigeon manure depends on the amount of water and sand which it contains, and on the very variable amounts of nitrogen, phosphoric acid, and potash. The following percentage results were obtained from 40 samples.

	Water.	N.	P_2O_5.	K_2O.
	3·80—40·00	1·47—5·04	1·00—2·77	0·71—2·57
Averages..	21·0	2·53	1·79	1·46

As much as 43·3 per cent. of sand was found. N. H. J. M.

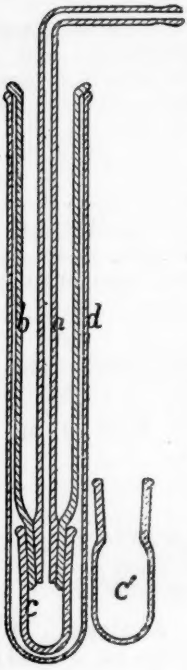
Analytical Chemistry.

New Method of Quantitative Spectrum Analysis. By GERHARD KRÜSS and H. KRÜSS (*Zeit. anorg. Chem.*, 1895, **10**, 31—43). —According to Lambert, if a ray of monochromatic light is passed through a layer of thickness m, and its luminosity is reduced $1/n$th by a layer of unit thickness, the original luminosity J becomes $J' = J/n^m$. Assuming that the reduction in luminosity is the same for a layer of solution of thickness m and concentration c as for a layer of thickness c and concentration m, and that the luminosity is reduced $1/n$th by a layer of thickness 1 and concentration 1, then $J' = J/n^{mc}$. Placing $n^{mc} = x$ we get $\log x = mc \log n$, or if $x = 10$, a condition that can be realised by so arranging the experiment that the luminosity of the light used is reduced to 1/10th of its original value by absorption in the solution,

$$c = \frac{1}{m \log n}.$$

It is evident that n is a constant for one and the same substance, and represents what may be termed the specific absorptive power of that substance. The constant k may be taken to represent the quantity $1/\log n$, and, therefore, $c = k/m$. If k has been determined by observation with a solution of known concentration, it will only be necessary to determine the thickness of the layer, m, of a similar solution of unknown concentration, required to reduce the luminosity to 1/10th of its original value, in order to find, c, the concentration. The authors describe a new spectrocolorimeter with the aid of which a comparison of solutions of different concentration can be effected.

H. C.



Separation of Minerals of High Specific Gravity. By SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1895, [3], **50**, 446—448).—A description is given of a better form of apparatus than that previously described by Penfield and Kreider (Abstr., 1894, ii, 456), to be used in the separation of minerals by aid of Retgers' double silver and thallium nitrate (Abstr., 1893, ii, 294). The tube *b*, containing the heavy liquid and the material to be separated, fits into the cap *c*, and has its lower end closed by the stopper *a*; the whole is placed in a tube *d* in hot water. As the liquid is diluted, the successively lighter portions of the material are collected from the cap *c*. For dealing with large quantities of material, the larger cap *c'* is used. With larger amounts of thallium nitrate (than $TlNO_3 : AgNO_3 = 1 : 1$), the density and melting point increase until, for the pure salt, sp. gr. = 4·94 and m. p. = about 250°. As Retgers' liquid acts on mineral sulphides, it cannot be used for their separation. The specific gravity of the separated fragments is conveniently determined by weighing in water in a small tube suspended from the balance arm.

L. J. S.

New Reagent for Bromine and Iodine. By J. H. KASTLE (*Amer. Chem. J.*, 1895, **17**, 706—708).—Dichlorobenzenesulphonamide liberates bromine and iodine from metallic bromides and iodides, and can be used either in the solid state or in carbon bisulphide solution; it is recommended as a reagent instead of chlorine water, but, like this, excess must be avoided, otherwise iodine trichloride will be formed. It is possible to recognise the presence of iodine in solutions containing 0·0000127 and 0·00000635 gram, together with 0·04 and 0·00036 gram bromine respectively.

J. B. T.

Quantitative Separation of Bromine and Chlorine. By STEFAN BUGARSZKY (*Zeit. anorg. Chem.*, 1895, **10**, 387—397).—The mixture of chloride and bromide is treated with from 50 to 100 c.c. of one-tenth normal potassium hydrogen iodate (according to the amount of bromine present), then with 10 c.c. of sulphuric acid (20 per cent. by volume), and the whole made up with water to 200 c.c. and boiled in a ½-litre flask until the volume is reduced to 60—80 c.c., whereby the liberated bromine and iodine are evolved. The residue in the flask is made up to 100 c.c. Half of this, diluted to 100 c c., is treated with a little potassium iodide and titrated with 1/10th normal sodium thiosulphate. The amount of bromine is then calculated from the quantity of iodic acid used up by the oxidation.

The remaining half of the 100 c.c. is treated with sulphurous acid to reduce the iodic acid, the hydrogen iodide decomposed by sodium nitrite, the solution then boiled until all the iodine is expelled, and the chlorine estimated by Volhard's method. The results are fairly accurate. Instead of determining the chlorine separately, the total amount of chlorine and bromine can be estimated by Volhard's method, and then the bromine estimated by the above method.

E. C. R.

Estimation of Sulphurous Anhydride and Sulphuric acid in the Products of Combustion of Coal Gas. By MAXIMILIANO DENNSTEDT and CÆSAR AHRENS (*Zeit. anal. Chem.*, 1896, **35**, 1—10).—The authors have repeated the work of Uno Collan (Abstr., 1895, ii, 368), with the following modification. A flask of 11 litres capacity was fitted with a cork, through which passed three tubes. One of these, reaching to the bottom, was recurved and furnished with a jet for burning the gas; a second served for the admission of purified air; and the third was connected with a long Liebig's condenser sloping upwards. To the upper end of the condenser there was attached a Drehschmidt's absorption apparatus, with a Bunsen pump for aspirating a current of air through the whole system. It was assumed that the sulphuric acid formed would be retained in the flask and condenser, the sulphurous anhydride alone passing into the absorption apparatus. The results obtained were much more concordant than those of Collan, but the amount of sulphurous anhydride calculated from the chromic acid reduced was only (on the average) 80 per cent., whilst that found gravimetrically in the absorbing liquid was 92·5 per cent. of the whole. Seven flasks moistened with water, were then interposed between the condenser and the absorption apparatus. Sulphuric acid, to an average amount of 0·5 per cent., condensed in each of these flasks. The irregularities in the results seeming to be connected with variations in the air supply, the experiment was made of varying the relation of the sulphur to the oxygen by replacing the air by pure oxygen in one series of experiments, and in another increasing the sulphur by vaporising into the gas a known quantity of carbon bisulphide. With the oxygen atmosphere as much as 37 per cent. of the sulphur was directly burnt to sulphuric acid, whilst the addition of the carbon bisulphide caused an increase in the proportion escaping as sulphurous anhydride.

These facts are regarded as indicating that although sulphurous anhydride is the chief direct product of the combustion, it nevertheless, when diffused through an excess of atmospheric air, continues to oxidise until it is wholly converted into sulphuric acid. The injurious effects in rooms where coal gas is burnt are therefore in no way diminished by the fact that the sulphuric acid is formed at a distance from the flame, instead of in the flame itself. M. J. S.

Estimation of Nitrogen in Peruvian Guano. By HEIBER (*Landw. Versuchs-Stat.*, 1895, **46**, 407—408).—The nitrogen in several samples of guano was determined by the Jodlbauer method, and by the washing out process. The guano was mixed with 2 parts of gypsum, and the acid (containing 40 grams of phenol per litre) added gradually, keeping well cooled; zinc dust was gradually added in small quantities. Loss of nitric oxide and of nitrophenol was thus avoided. When all the zinc dust (3 grams) had been added, the whole was kept for a long time, after which 20 c.c. of strong sulphuric acid and mercury (2 grams) were added, and the decomposition proceeded with.

In the washing out method, the separation of the soluble and insoluble portions was carried out in the usual manner with 5 grams of guano. The filtrate was made up to 500 c.c., of which 100 c.c. was treated with caustic soda, iron dust, and zinc dust, and distilled after some hours.

The results, unlike those obtained by Haselhoff (Abstr., 1895, ii, 138), showed that the Jodlbauer method gave the higher percentages, owing probably to the fact that such compounds as guanine and uric acid are not decomposed by dilute soda. N. H. J. M.

Kjeldahl's Method and Platinochlorides. By W. van Dam (*Rec. Trav. Chim.*, 1895, **14**, 217—226).—Délepine (Abstr., 1895, ii, 290) has shown that the percentage of nitrogen in certain platinochlorides, as estimated by Kjeldahl's method, falls considerably below the theoretical value. The author confirms this, and shows that by prolonging the heating and applying Gunning's modification of the method, the results are not improved. When Wilfarth's modification is employed (addition of a drop of mercury), the platinochlorides of several amines were found to yield satisfactory values for the percentage of nitrogen. Even under these circumstances, however, ammonium platinochloride yields low results. The last-mentioned compound gives theoretical values, as do the platinochlorides of all the amines tried, when a little zinc-dust is added to the concentrated sulphuric acid during the heating therewith.

Ethylamine aurochloride and ethylamine mercurochloride give good results, both by Gunning's modification, and also by that of Wilfarth. The author has demonstrated that the whole of the nitrogen is evolved as such when ammonium platinochloride is heated with concentrated sulphuric acid for five hours. A. R. L.

Toxicological Estimation of Phosphorus. By Pietro Spica (*Chem. Centr.*, 1895, i, 562; from *Boll. Farm.*, 1895, 2).—After a portion of the material has been qualitatively tested by Mitscherlich's process, the remainder is treated as follows. It is put into a flask which is connected with a carbonic acid apparatus; the flask, after the air has been expelled, is gently heated on a sand bath, and the volatile products are passed through three Peligot tubes charged with a neutral solution of silver nitrate. To see whether all the phosphorus has passed over, the tubes are replaced by fresh ones; six to eight hours heating generally suffices to expel all the phosphorus.

The silver solution is oxidised, and, after precipitating the silver, the phosphoric acid is estimated by means of molybdate solution. The residue in the flask may still contain phosphorus in an incomplete state of oxidation, and capable of yielding hydrogen phosphide. Zinc is therefore added, and also dilute sulphuric acid a little at a time, so as to keep up a feeble current of hydrogen for about six days. All this time, a current of carbonic anhydride is also passed;

the gases are passed through Peligot tubes charged with silver nitrate solution, and should any precipitate form it is treated as before. L. DE K.

Testing for Arsenic in the Presence of Selenium. By L. DAWYDOW (*Chem. Centr.*, 1895, i, 811; from *Chem. Zeit. Rep.*, **19**, 70).—The presence of selenium interferes with Marsh's test, and also with Bettendorf's stannous chloride test, and if present in large quantities, the first may fail altogether. The author recommends precipitating both arsenic and selenium by means of hydrogen sulphide, and then acting on the mixed sulphides with ammonium carbonate. The arsenical solution may then be further tested. L. DE K.

Decomposition of Silicates by Boric acid. By PAUL JANNASCH (*Ber.*, 1895, **28**, 2822—2823).—Silicates may readily be brought into condition for analysis by fusion with boric acid. The boric acid is removed by repeatedly evaporating the solution with hydrochloric acid and methylic alcohol. A. H.

Estimation of Argon. By TH. SCHLOESING, jun. (*Compt. rend.*, 1895, **121**, 525—528).—The author describes an arrangement of an ordinary mercury pump for passing a comparatively small, measured volume of nitrogen, containing argon, repeatedly through a tube containing heated magnesium. The last traces of argon are swept out of the tubes at the close of the operation by means of carbonic anhydride, and, before measuring the gas, any traces of nitrogen or of combustible gases are removed by sparking with oxygen in presence of potash, the excess of oxygen being afterwards absorbed by phosphorus (compare this vol., ii, 166). C. H. B.

Estimation of Calcium and Magnesium Carbonates in Soil. By ROBERT MAUZELIUS and ALBERT VESTERBERG (*Bied. Centr.*, 1895, **24**, 583—584; from *Redogörelse f. verksamheten vid Ultuna Landtbruksinst. år*, 1894. *Upsala*, 1895, 62—71).—Extraction of calcium and magnesium carbonates with hydrochloric acid, and precipitation gives too high results. Carbonic anhydride was determined in 16 loamy soils (0·05 to 18·13 per cent. of CO_2) with a modified Fresenius' apparatus, and also the amount of lime and magnesia extracted by 0·9 to 1 per cent. hydrochloric acid. The carbonic anhydride represented by the lime and magnesia so determined, exceeded that actually found by 0·25 to 0·85 per cent. The results show that the amounts of readily decomposed zeolithic lime compounds in soils are too great to be neglected, especially in the case of soils poor in lime. In exact estimations, the carbonic anhydride should also be determined.

By increasing the strength of the acid to 4 per cent., much more lime and magnesia were dissolved. N. H. J. M.

Volumetric Estimation of Lead. By ALLERTON S. CUSHMAN and J. HAYES-CAMPBELL (*J. Amer. Chem. Soc.*, 1895, **17**, 901—904).—Various methods for the volumetric estimation of lead have been tried. A modified form of Schwartz-Diehle's method (Abstr., 1880, 752) is suggested. After the lead chromate has been filtered off, the excess of dichromate in solution is titrated by means of a standardised solution of ferrous ammonium sulphate, using potassium ferrricyanide as an indicator, under exactly the same conditions as observed in standardising dichromate solutions. The results obtained are a trifle low. Low's method (*J. Anal. Chem.*, **6**, 12) gave too high results. Knight's modification of Hempel's method (*ibid.*, **6**, 11) did not yield concordant results. J. J. S.

Electrolytic Separations. By EDGAR F. SMITH and DANIEL L. WALLACE (*J. Amer. Chem. Soc.*, 1895, **17**, 612—615).—Mercury may be electrolytically separated from cadmium; gold from cobalt, arsenic, copper, zinc, and nickel; silver from zinc, nickel and cobalt, be operating at 65° in presence of potassium cyanide.

With a current of 0·02—0·08 ampère for mercury, 0·1 for gold, and 0·04 for silver, the deposition of the metal is generally complete in 3—3½ hours. L. DE K.

Separation of Manganese from Zinc in Ammoniacal Solution by means of Hydrogen Peroxide under Pressure. By PAUL JANNASCH and E. VON CLOEDT (*Zeit. anorg. Chem.*, 1895, **10**, 405—407).—A weighed quantity of manganese and zinc salts is dissolved in water (20 c.c.) and glacial acetic acid (10 c.c.), and poured into a cold mixture of 5 to 6 per cent. hydrogen peroxide (30 c.c.), concentrated ammonia (60 c.c.) and water (20 c.c.). The mixture is allowed to remain for 1½ hours in a thick walled glass flask closed with a rubber bung and capable of withstanding pressure, and is then heated for 1½ hours at the temperature of boiling water. The precipitated hydrated manganese dioxide is washed with ammonia and then with hot water; five to seven washings are usually sufficient to remove all traces of zinc. The filtrate containing the zinc is evaporated to dryness on the water bath, and then for a short time at 120—130° to remove the last trace of ammonium acetate. The residue is dissolved in water and dilute hydrochloric acid, and the zinc precipitated with sodium hydrogen carbonate. E. C. R.

Separation of Iron from Beryllium. By ELIZABETH A. ATKINSON and EDGAR F. SMITH (*J. Amer. Chem. Soc.*, 1895, **17**, 688—689).—The authors adopt the process introduced by von Knorre (Abstr., 1893, ii, 500) and separate the iron from beryllium by means of nitroso-β-naphthol. The iron solution containing about 0·1 gram of the metal is diluted to about 200 c.c. and 125 c.c. of a solution of the reagent in 50 per cent. acetic acid is added and the mixture is left for 24 hours. The iron precipitate is then collected and washed, first with 50 per cent. acetic acid and then with water until free from soluble matter. Owing to the slightly explosive nature of the compound, it is, after drying, mixed with an equal bulk of powdered oxalic acid and gradually heated until the carbon is burnt off, and the iron converted into oxide. The test-analyses show the accuracy of the process. L. DE K.

Separation of Arsenic from Iron and Manganese. By PAUL JANNASCH and H. KAMMERER (*Zeit. anorg. Chem.*, 1895, **10**, 408—414; see also Abstr., 1895, ii, 423).—*Separation of iron from arsenic.* Ammonium iron alum (0·5—0·6 gram), and arsenious anhydride (0·25—0·3 gram) are dissolved in 3 c.c. of a mixture of equal volumes of concentrated hydrochloric and nitric acids and a little water, and evaporated to dryness; the residue is dissolved in water and hydrogen peroxide, and poured into a mixture of sodium hydroxide (5 grams) water (50 c.c.) and hydrogen peroxide (30 c.c.). The mixture is heated to boiling, diluted to 250—300 c.c. and filtered. The iron precipitate is redissolved in dilute nitric acid and a little hydrogen peroxide, and again precipitated with ammoniacal hydrogen peroxide. The filtrates are evaporated in order to expel the ammonia, acidified with nitric acid, allowed to cool, and the arsenic precipitated with ammonia and magnesium chloride and weighed as $Mg_2As_2O_7$. *Manganese and arsenic* are separated in a similar way.

Separation of Iron from Nickel, Zinc, and Copper, in Hydrochloric acid Solution.—Ammonium iron alum, and nickel ammonium sulphate (0·5 gram of each) are dissolved in water (25 c.c.) and concentrated hydrochloric acid (6·7 c.c.), and poured into a mixture of ammonia, hydrogen peroxide, and water. The mixture is heated on the water bath, and the iron precipitate washed and redissolved in dilute hydrochloric acid containing hydrogen peroxide, and then again precipitated. The filtrates are evaporated to expel the ammonia, 1 gram of hydroxylamine added, and the nickel precipitated with excess of sodium hydroxide. The separation of iron from zinc, and iron from copper is carried out in a similar manner. The preceding separations are more easily effected when acetic acid is used instead of hydrochloric acid, since in the evaporation of the filtrates, the ammonium acetate is more easily volatilised. E. C. R.

Chromium Estimations. By JOHN E. STEAD (*Chem. Centr.*, 1895, i, 623—624; from *Journ. Iron and Steel Inst.*).—The author has improved Galbraith's process for the testing of chrome steel. The sample is dissolved in dilute sulphuric acid, filtered, the solution diluted to about 300 c.c., and heated to boiling. Strong solution of potassium permanganate is now added until the red colour is permanent for 10 minutes, then 80 c.c. of 10 per cent. hydrochloric acid, and the liquid heated until decolorised; 150 c.c. of water is added, about 100 c.c. boiled off to expel the chlorine, and the chromium is then titrated. The residue insoluble in dilute sulphuric acid is mixed with 0·5 gram of a mixture of 200 parts of calcium oxide, 50 parts of potassium carbonate and 50 parts of sodium carbonate and heated to intense redness for half an hour; the chromium is afterwards titrated in hydrochloric acid solution with ferrous sulphate and potassium dichromate.

Another process consists in dissolving 2 grams of the sample in hydrochloric acid; without filtering, the liquid is nearly neutralised with a 2 per cent. solution of sodium hydroxide, and after diluting to 300 c.c., 10 c.c. of a 5 per cent. solution of disodium hydrogen phosphate and 30 grams of sodium thiosulphate is added. After boiling to expel the sulphurous acid, 20 c.c. of a saturated solution of sodium acetate is added and the boiling continued for 5 minutes; the precipitated chromium phosphate is then washed with a 2 per cent. solution of ammonium nitrate, dried, calcined, and fused with the above lime mixture. The melt, dissolved in 30 c.c. of hydrochloric acid and 150 c.c. of water, is boiled for 10 minutes and titrated. The process may be used in presence of vanadium. In this case, the chromium must be titrated by means of ferrous sulphate and potassium permanganate in presence of sulphuric acid.

L. DE K.

Separation of Chromium from Manganese, Iron, and Aluminium. By PAUL JANNASCH and E. VON CLOEDT (*Zeit. anorg. Chem.*, 1895, **10**, 398—404).—*Separation of Manganese and Chromium.*—Manganese ammonium sulphate and ammonium chrome-alum (0·35—0·4 gram) are dissolved in water (50 c.c.) and concentrated nitric acid (5 c.c.), and the solution poured into a mixture of 3 per cent. hydrogen peroxide (40 c.c.) and soda (1 : 5, 40 c.c.). The mixture is heated to boiling, and the precipitate of hydrated manganese dioxide washed with dilute ammonia containing hydrogen peroxide, is dissolved in nitric acid containing hydrogen peroxide, and again subjected to the above method of precipitation. The precipitate, which contains traces of soda, is redissolved and precipitated with ammoniacal hydrogen peroxide, then dried, and heated to a constant weight. The filtrates, which contain the chromium as sodium chromate, are concentrated and treated with hydrochloric acid and alcohol, whereby the chromate is converted into chromium chloride; and the solution, freed from alcohol, is diluted, treated with hydroxylamine chloride (0·5 gram) and carefully precipitated with ammonia.

Manganese and chromium are more readily separated by treating their mixed salts under pressure with ammoniacal hydrogen peroxide, whereby only one precipitation is necessary. The solution of the salts mixed with 6 per cent. hydrogen peroxide (80 c.c.) and concentrated ammonia (30 c.c.) is allowed to remain a short time in a thick-walled glass flask closed with an india-rubber stopper, and is heated for 1—2 hours at the temperature of boiling water; the flask is then opened, and the precipitate washed and treated as previously described. It is most essential to use 6 per cent. hydrogen peroxide, as, if weaker solutions are employed, the precipitate contains chromium. *Iron and chromium* are easily separated in the same way.

Aluminium and chromium are separated in a similar way, but pressure is not necessary. 5—6 per cent. hydrogen peroxide is used, and after the mixture has been allowed to remain 1—2 hours in the cold, it is heated until all but the last traces of ammonia are removed. The precipitate of aluminium hydroxide must be washed with great care.

E. C. R.

Warning against the Use of Fluoriferous Hydrogen Peroxide in Estimating Titanium. By WILLIAM F. HILLEBRAND (*J. Amer. Chem. Soc.*, 1895, **17**, 718—719).—In estimating titanic acid colorometrically, the hydrogen peroxide employed must be free from fluorine compounds, as even a minute amount will weaken the yellow coloration, or even entirely prevent its formation. L. DE K.

Electrolytic Estimation of Ruthenium. By EDGAR F. SMITH and HARRY B. HARRIS (*J. Amer. Chem. Soc.*, 1895, **17**, 652—654).—The authors have found that ruthenium may be conveniently deposited by electrolysis best in presence of acid sodium phosphate. Sodium acetate may also be used, but the deposit is then inclined to be spongy.

The platinum dish in which the decomposition is carried out must be coated inside with copper. If the amount of ruthenium does not much exceed 0·05 gram, a current of 0·01—0·05 ampère acting for about six hours will suffice. Ruthenium may be thus separated from iridium. L. DE K.

Testing Ethereal Oils. By EDUARD HIRSCHSOHN (*Chem. Centr.*, 1895, i, 695—696; from *Pharm. Zeit. Russ.*, **34**, 97—102, 113—119).—Two kinds of oil of thyme exist; when distilling samples of the first group, the first two distillates measure over 70 per cent., of which nearly 13 per cent. is soluble in 2—4 vols. of 70 per cent. alcohol, whilst the second group yields 62 per cent. of the first two distillates, 12—31 per cent. of which is soluble. The different fractions give different colour reactions, showing that the commercial oils vary in constitution.

Oil of patchouli should dissolve in an equal bulk of 90 per cent. alcohol; if not, adulteration with copaiba may be suspected.

Oils of rosemary of French, Italian, and Spanish origin all give the iodol reaction. When distilling the French samples, the first two fractions amounted to 62—68 per cent., and the last fractions to 20—27 per cent.; the first fraction is soluble in 3 vols. of 90 per cent. alcohol, and the last fractions give, with bromoform and acetic acid, a strong reaction. Of Italian samples, the first distillate amounts to 46 per cent. soluble in 10 vols. of 80 per cent. alcohol; the first two distillates amount to 78 per cent. The first distillates of the Spanish oils are more soluble in 80 or 70 per cent. alcohol. L. DE K.

Estimation of Simple Cyanides in the Presence of Compound Cyanides and certain other Substances. By J. E. CLENNELL (*Chem. News*, 1895, **72**, 227—229).—The iodine method is not seriously interfered with by ferrocyanides, ferricyanides, or thiocyanates, but with the silver nitrate method the first salts render the results somewhat too high; the second salts have the reverse effect, and the third salts render the end reaction obscure. In the presence of zinc, neither method is trustworthy, so that the total cyanide and zinc must then be determined. The zinc is determined by adding a known excess of standard ferrocyanide, acidifying and titrating the unexhausted residue with permanganate; in the absence of substances which react with iodine, the total cyanide may be estimated in neutral or neutralised solutions containing both simple cyanides and zinc double cyanide by adding excess of ferrocyanide, and titrating with standard iodine. D. A. L.

Technical Analysis of Cyanide Working Solutions. By WILLIAM BETTEL (*Chem. News*, 1895, **72**, 286—287).—The methods apply to the McArthur-Forrest working solutions containing zinc. Free cyanide is estimated by titrating 50 c.c. with silver nitrate to faint opalescence or precipitate; this will indicate (if sufficient ferrocyanide is present to form a flocculent precipitate of zinc ferrocyanide) the free cyanide and cyanide equal to 7·9 per cent. of the potassium zinc cyanide present. Hydrocyanic acid is estimated in 50 c.c. by adding sodium or potassium hydrogen carbonate and titrating as for free cyanide. Double cyanides are estimated by adding excess of caustic soda to 50 c.c. of the solution, then a few drops of 10 per cent. potassium iodide, and titrating with silver nitrate to opalescence. On deducting the free cyanide and hydrocyanic numbers, the result is potassium cyanide due to double cyanide, the quantity of which may be obtained by multiplying by 0·9493 and adding 7·9 for every 92·1 parts of potassium zinc cyanide indicated. D. A. L.

Estimation of Rosin Oil in Mineral Oil. By J. KLIMONT (*Chem. Centr.*, 1895, i, 563; from *Chem. Rev. Fett Harz-Ind.*, 1895, **10**, 4—5).—The author applies his bromine process (Abstr., 1895, ii, 91). Rosin oils give an average turpentine number (*loc. cit.*) of 51; mineral lubricating oils of only about five. The amount of rosin oil may, therefore, be estimated by the aid of the equations $51x/100 + 5y/100 = a$ and $x+y = 100$, in which a represents the turpentine number of the sample, x the percentage of rosin oil, and y the amount of mineral oil. L. DE K.

Estimation of Total Solids and Alcohol in Wine by an Optical Method. By E. RIEGLER (*Zeit. anal. Chem.*, 1896, **35**, 27—31).—The refractive index of a wine may be regarded as consisting of three parts—a, that due to the water; b, that due to the solids; c, that due to the alcohol. The presence of each gram of alcohol in 100 c.c. of the wine causes an increase of 0·00068 in the index of refraction. In the wine freed from alcohol, each gram of solids raises the index by 0·00145 (extremes observed are 0·00137 and 0·00150). A quantity of the wine (25 c.c.), measured in a flask, is evaporated on the water bath to about 8 c.c., returned to the flask, and made up with distilled water to the original volume. The refractive index $(a+b)$ of the resulting solution, that of the original wine (N), and that of distilled water (a) are then determined after the three liquids have been brought to exactly the same temperature by plunging them into a vessel of water of the temperature of the workroom. Pulfrich's refractometer (*Zeit. anal. Chem.*, **28**, 81) gives results to the 5th decimal place with ease and rapidity. Then $\dfrac{N - (a + b)}{0{\cdot}00068}$ gives grams of alcohol, and $\dfrac{(a + b) - a}{0{\cdot}00145}$ grams of solids per 100 c.c. of wine. From the examination of a single sample of beer, the constants seem to be the same for beer as for wine. M. J. S.

The Cyano-cupric Estimation of Glucose. By ALFRED W. GERRARD (*Pharm. J. Trans.*, 1895, [3], **25**, 913).—The author has improved the formula for his cyano-cupric test for glucose, and now adopts the following. To 10 c.c. of Fehling's solution, heated to boiling in a porcelain dish, a 5 per cent. solution of potassium cyanide is gradually added until only a very faint blue colour remains. Another 10 c.c. of Fehling's solution is now added, and while the mixture is kept boiling, the solution of sugar or urine is run in slowly from a burette until the blue colour disappears. The volume of liquid required will contain 0·05 gram of glucose. R. R.

Analysis of Urine. Estimation of small Quantities of Sugar by means of Nylander's Bismuth Solution. By GEORG BUCHNER (*Chem. Centr.*, 1895, i, 303; from *Münch. med. Wochschr.*, **41**, 991).—The bismuth solution should be added to the urine in the proportion of 1—10. Ammonium carbonate in large quantity, albumin, rhubarb, senna, salol, antipyrine, turpentine, or other drugs likely to yield compounds with glycuronic acid, must be absent. The test will distinctly show the presence of 0·025 per cent. of sugar by the grey colour of the phosphatic precipitate. The author has, however, noticed urines which give this reaction, although, when examined by the phenylhydrazine test, they were found to contain no sugar. The reaction with the bismuth was here probably caused by the presence of uroerythrin which occurs in abnormal quantity in the urine of persons suffering from fever, rheumatism, liver complaints, or diarrhœa, and also often contains an increased amount of uric acid, creatinine, and colouring matters. The greyish colour of the phosphatic precipitate can only be taken as an indication of the presence of sugar when a pure white deposit is obtained after boiling with aqueous potash. L. DE K.

Estimation of Sugar in Preserved Fruits. By JOS. MAYRHOFER (*Chem. Centr.*, 1895, i, 898—899; from *Forsch.-Ber. Lebensm. u. Hyg.*, 1895, 75—79).—The author states that the official method for the detection of glucose in jams is not trustworthy, and proposes a modification. The sugar mixture is inverted and titrated with Fehling's solution, and the result calculated as cane sugar, from which the polarisation is then calculated. If glucose is present, the calculated polarisation will be more than the observed, and 5 per cent. of this substance may thus be detected. L. DE K.

Estimation of Cane Sugar in Malt. By ED. JALOWETZ (*Chem. Centr.*, 1895, i, 934; from *Zeit. angw. Chem.*, 1895, 208—209).—The actual polarisation of the solution is first observed in the 20-cm. tube of Laurent's apparatus; 75 c.c. is then heated with 5 c.c. of hydrochloric acid (sp. gr. 1·88) in a narrow necked 100 c.c. flask at 69—71° for 10 minutes. After inversion, 1 gram of animal charcoal is added, the liquid cooled to 20°, then made up to the mark, and filtered. The filtrate is again polarised, and due allowance made for dilution. The amount of cane sugar in 100 c.c. of malt infusion is found by dividing the difference in the two polarisations by 1·782.

L. DE K.

Estimation of Formaldehyde. By M. KLAR (*Zeit. anal. Chem.*, 1896, **35**, 116—117; from *Pharm. Zeit.*, **40**, 611).—Formaldehyde may be estimated by treatment with an aqueous solution of aniline, when methyleneaniline, $C_6H_5{\cdot}N{:}CH_2$, is precipitated, and may be collected, dried at 40°, and weighed. A more expeditious method consists in titrating the excess of aniline in the filtrate, using Congo-red as indicator. For such a formaldehyde solution as that of the German Pharmacopœia, 400 c.c. of aniline solution (3 grams of aniline per litre) is placed in a flask, and 1 c.c. of the formaldehyde solution added by drops with shaking. The mixture is made up to 500 c.c., and, after some time, filtered. The excess of aniline is then estimated in 50 c.c., taking as the end point that at which the red colour acquires a strong, bluish tone, remaining unaltered on the further addition of a small quantity of acid. The original aniline solution is similarly titrated. One c.c. of N/10 acid corresponds with 0·003 gram of formaldehyde.

M. J. S.

Estimation of Benzoyl and Acetyl Groups. By RICHARD MEYER and HEINRICH MEYER (*Ber.*, 1895, **28**, 2965—2969).—About 0·5 gram of the substance is placed in a round-bottomed flask of 250 c.c. capacity, 30—50 c.c. of alcohol is added, and then caustic potash in excess, the whole being heated in a reflux apparatus until the hydrolysis is complete. The contents of the flask are then acidified with a strong solution of phosphoric acid, and distilled with steam; after 1—1½ litre has passed over, each successive 150 c.c. or so of the distillate is titrated until it is found to contain no more acid. The bulk of the distillate is meanwhile treated with a drop of rosolic acid and a measured excess of N/10 soda, rapidly concentrated in a platinum, silver, or nickel dish over a spirit burner to a volume of 100—150 c.c., and the excess of alkali determined by titration with N/10 acid in boiling solution. The results obtained are a little high, 0·5—1·0 c.c. more alkali being used than is theoretically necessary, owing to the absorption of acid during evaporation. The caustic potash and phosphoric acid used must not contain either nitrous or nitric acid; a little potassium chloride in the potash does not matter when phosphoric acid is used, but it would be prejudicial were sulphuric acid used instead, as hydrochloric acid would then be set free from it.

The above applies to the estimation of benzoyl groups. Acetyl groups can be estimated in the same way, but more easily; the distillation, which can be stopped when the distillate is no longer acid to litmus paper, does not take so long; phenolphthaleïn should be used as an indicator in the titration.

C. F. B.

Separation of Solid and Liquid Fatty acids. By LEONARD DE KONINGH (*J. Amer. Chem. Soc.*, 1895, **17**, 740—741).—Twitchell (*ibid.*, 290) has attempted to show that Muter's process for the separation of solid and liquid fatty acids is erroneous on account of the slight solubility of the lead salts of the solid fatty acids in ether and their probable greater solubility in ether containing lead oleate. The iodine figure of the liquid acids is also said to be erroneous, chiefly on account of a supposed oxidation which occurs when applying this method. The author thinks that, when present in fair proportion, the separation of the liquid from the solid fatty acids by the lead ether method is fairly complete; the iodine figures of the isolated fatty acids are also trustworthy, and the danger of oxidation is greatly exaggerated. L. DE K.

Estimation of Uric acid by Fehling's Solution. By E. RIEGLER (*Zeit. anal. Chem.*, 1896, **35**, 31—34).—An alkaline solution of uric acid boiled with Fehling's solution throws down cuprous oxide, the average amount of copper in the precipitate being 0·8 gram for 1 gram of uric acid. The extreme values in 10 experiments were 0·7812 and 0·8333 gram. To estimate uric acid in urine, it is first separated in the form of ammonium urate as follows. 200 c.c. of urine is mixed with 10 c.c. of a saturated solution of sodium carbonate, and after half an hour, the precipitate of phosphates is filtered off, and washed with about 50 c.c. of hot water. The filtrate, mixed with 20 c.c. of a saturated solution of ammonium chloride, is stirred well, and left for five hours. The precipitate is then collected on a small filter, washed with 50 c.c. of water, and then rinsed through the pierced filter with 50 c.c. of water into a 300 c.c. beaker; 60 c.c. of Fehling's solution (30 c.c. of copper sulphate solution containing 69·2 grams of the crystallised salt per litre, and 30 c.c. of alkaline tartrate solution containing 346 grams of sodium potassium tartrate, and 250 grams of potassium hydroxide per litre) is added, and the mixture boiled gently for five minutes. After thorough subsidence, the liquid is filtered through a small (9 cm.) close filter, and the precipitate thoroughly washed with hot water. It is then dissolved from the filter by 20 c.c. of hot nitric acid of 1·1 sp. gr., and the filter washed with about 60 c.c. of water. The solution is neutralised with powdered dry sodium carbonate, until a slight turbidity is produced; the turbidity is cleared up with a few drops of dilute sulphuric acid, and the whole made up to 100 c.c. 25 c.c. of the liquid is then mixed with 1 gram of potassium iodide, and after 10 minutes, starch paste is added; the liberated iodine is then titrated by thiosulphate solution, made by diluting 126 c.c. of N/10 solution to 500 c.c. 1 c.c. of this solution corresponds with 0·002 gram of uric acid. M. J. S.

Detection of Salicylic acid in Beer. By R. J. L. SCHOEPP (*Ned. Tydschr. Pharm, &c.*, **7**, 67—71).—The process generally employed is to agitate the acidified sample with a mixture of 2 parts of ether and 1 part of light petroleum, as ether alone also dissolves colouring matters. The author found, however, that when applying the well known ferric chloride test, the salicylic acid reaction was occasionally obtained with samples which were undoubtedly free from adulteration, this reaction being due to maltol, a substance recently isolated by Brand (Abstr., 1894, i, 270) from roasted malt. Maltol does not, however, give any particular reaction with Millon's reagent, whereas salicylic acid gives a dark red coloration. In beer analysis, this test should be employed, as well as the ferric chloride test.

L. DE K.

Examination of Oil of Bergamot. By ARTHUR BORNTRÄGER (*Zeit. anal. Chem.*, 1896, **35**, 35—38).—The proportion in bergamot oil of the linalol acetate, which is its essential odoriferous constituent (Abstr., 1892, 868), being fairly constant, namely, 34—43 per cent. according to Schimmel and Co., 37·6—39·9 per cent. according to the author, an estimation of its amount by saponification serves to detect the presence of oil of turpentine, the most usual adulterant of bergamot oil. About 2 grams of the oil is cohobated for 1—2 hours with 20 c.c. of N/2 alcoholic potash, and titrated back with N/2 sulphuric acid and phenolphthaleïn.

The oil evaporated on the water-bath should not leave more than 6 per cent. of residue. This residue contains 1—2 per cent. of saponifiable substances, the amount of which should be deducted when estimating the linalol acetate. A large percentage of non-volatile saponifiable substance would point to the addition of a fatty oil. Colophony would be indicated by a high residue containing free acids (abietic, &c.), the genuine oil containing only traces either of colophony or of free acid.

M. J. S.

Estimation of Fat in Milk. By H. WELLER (*Chem. Centr.*, 1895, i, 898; from *Forsch. Ber. üb. Lebensm.*, 1895, 80—83).—10 c.c. of the sample is poured into a weighed cylindrical aluminium tube containing about 3 grams of cotton wool, previously extracted with ether. The exact quantity of milk is found by reweighing the tube.

After drying in a special drying apparatus, the total solids are obtained. After extracting the fat in a suitable extractor, the residue is again dried and reweighed. The loss represents the fat, but after evaporating the ether, the fat may be also directly weighed.

L. DE K.

Rapid Estimation of Fats in Milk: a new Lactobutyrometer. By ANTONIO LONGI (*Gazzetta*, 1895, **25**, i, 441—451).—The author describes and sketches a new simple form of lactobutyrometer, which he has used with excellent results for some years past.

W. J. P.

Examination of Lard for Impurities. By DAVID WESSON (*J. Amer. Chem. Soc.*, 1895, **17**, 723—735).—The author has investigated most of the published physical and chemical methods for the analysis of lard, and concludes that, unless the origin of the sample is known, no method gives satisfactory results, particularly if the amount of adulteration is small.

If cotton-seed oil is suspected, the only trustworthy test is the one based on the iodine absorption of the liquid fatty acids, but it must be remembered that American lard differs greatly from the European article, and has a much higher iodine absorption.

L. DE K.

General and Physical Chemistry.

The Atomic Refraction of Oxygen. By FRANCESCO ANDERLINI (*Gazzetta*, 1895, **25**, ii, 127—162).—The author has determined the refraction equivalents of a number of oxygen compounds of different types, for the hydrogen lines α, β, and γ, and gives the refraction and dispersion constants; the results for the ray H_α are summarised in the appended table. The methods of preparation and the criteria of purity of the several substances are given.

	t.	$P\frac{\mu_{H_\alpha}-1}{d}$.		$P\frac{\mu^2_{H_\alpha}-1}{(\mu^2_{H_\alpha}+2)d}$.	
		Observed.	Calculated.	Observed.	Calculated.
Dipropionyl	26·3°	101·53	100·8	60·28	60·18
”	5·6	101·78	100·8	60·78	60·18
Dibutyryl	20·0	133·2	131·2	79·76	78·42
Isodivaleryl	24·5	163·28	161·6	97·70	96·66
”	6·2	162·9	161·6	97·49	96·66
γ-Valerolactone	22·4	41·03	41·6	24·64	21·64
”	16·9	40·97	41·6	24·59	21·64
γ-Isocaprolactone	16·2	48·6	49·2	29·18	29·20
”	14·9	48·55	49·2	29·14	29·20
Pyrotartaric anhydride	13·7	41·54	42·4	24·81	24·90
Propionic anhydride	23·3	51·80	52·6	31·39	31·54
”	23·9	51·82	52·6	31·41	31·54
Isovaleric anhydride	26·7	82·66	83·0	49·85	49·78
”	23·2	82·57	83·0	49·98	49·78
Propoïn	16·6	52·59	51·8	31·62	31·28
Butyroïn	16·7	68·4	67·0	41·06	40·4
Isovaleroïn	17·4	82·8	82·2	49·6	49·52
Diphenylmethane	16·8	95·21	95·0	54·92	55·28
Succinic anhydride	20·4	34·10	34·8	20·37	20·35
Maleïc anhydride	19·20	33·09	34·6	20·28	20·04
Lactide	9·9	51·86	52·8	31·10	31·04
”	20·8	52·12	52·8	31·69	31·04
Benzoic anhydride	14·9	109·23	107·0	63·04	62·06
Benzile	13·0	108·14	104·2	63·40	60·48
”	7·0	107·55	104·2	63·56	60·48
Coumarin	7·3	73·0	68·6	43·18	39·70
”	7·7	73·0	68·6	42·91	39·70
Phenolphthaleïn	5·5	159·4	151·6	91·82	87·26
Dimethylfumaric anhydride	19·4	51·0	49·8	30·83	29·16
Terebic acid	24·4	58·0	58·4	35·8	35·50
Triphenylmethane	18·4	138·1	137·4	81·37	79·78

Maleïc, dimethylfumaric, and benzoic anhydrides, benzile, coumarin, and triphenylmethane were examined in benzene, lactide and terebic acid in acetone, succinic anhydride in acetic acid, and phenolphthaleïn in alcoholic solution; the other substances mentioned in the table were examined in the pure liquid state. Dipropionyl, dibutyryl, and isodivaleryl have been shown to be really diethylacetylenic dipropionate, dipropylacetylenic dibutyrate, and diisobutylacetylenic diisovalerate respectively (Klinger and Schmitz, Abstr., 1891, 890; Anderlini, this vol., i, 202); the molecular refractions are therefore calculated in accordance with these facts.

The difference between the observed and calculated values of the molecular refraction are usually too great to be ascribed to experimental error, showing that the refraction constants are intimately affected by small changes in constitution, which cannot yet be accurately valued owing to the lack of experimental data.

W. J. P.

Modified form of Polarimeter for Chemical Purposes. By Hans Heinrich Landolt (*Ber.*, 1896, **28**, 3102—3104).—The author describes a form of apparatus which facilitates the examination of rotatory liquids at temperatures extending over a wide range, the substance being introduced into a brass tube enclosed in a jacket constructed of sheet brass; a vertical, tubular limb of small bore allows for the contraction or expansion of the contents of the brass tube, the inner surface of which is gilded. Moreover, a simple lever replaces the micrometer screw for the purpose of controlling the analyser, and, by employing a Lippich polariser, the length of the instrument is reduced, owing to the fact that a 2-decimeter tube is sufficiently long for most purposes, consequent on the accuracy with which the neutral tint may be observed. M. O. F.

Cause of Birotation. By Edmund O. von Lippmann (*Ber.*, 1896, **29**, 203—204).—The author, in his book, *Chemie der Zuckerarten*, suggested stereochemical changes as the cause of birotation before either Lobry de Bruyn and van Ekenstein (this vol., i, 116), or Trey (*ibid.*, ii, 139). C. F. B.

Loss of Energy of a Battery during Electrolysis. By Hans Jahn (*Zeit. physikal. Chem.*, 1895, **18**, 399—425).—By the direct measurement of the heat developed in the battery, and the calculation of that developed in the circuit, the author obtains the total heat development per unit current, (I) without, (II) with, polarisation. The difference is the energy necessary for the decomposition of the corresponding quantity of the electrolyte, from which that necessary for the decomposition of the milligram equivalent is obtained, and the value of the polarisation is deduced. The last two values are given (for 0°) in the accompanying table, under the headings w and p, dp/dt being the heat coefficient (in volts) of the polarisation between 0° and 40°, at which temperatures the experiments were performed.

The values for the polarisation are, in all cases, markedly higher than those obtained by other methods. The difference between the heat value thus obtained and the heat of formation of the electrolyte must equal the heat produced in the decomposition cell. Owing to the Peltier effect, the quantities of heat produced at the two electrodes differ, and from the differences actually obtained the Peltier

	w.	p.	dp/dt.
Copper sulphate	79·86	1·756	−0·00508
Zinc sulphate	126·88	2·790	−0·00524
Cadmium sulphate	111·15	2·444	−0·00315
Copper nitrate	81·31	1·788	−0·00465
Lead nitrate*	—	2·267	−0·00460
Silver nitrate*	—	1·330	−0·00382

effect is determined, in the case of copper | copper sulphate, zinc | zinc sulphate and cadmium | cadmium sulphate junctions, the values so derived agreeing satisfactorily with those calculated from the thermo-electromotive forces of the junctions. Next is calculated the cathodic, and hence the anodic polarisation, the values for the latter being somewhat greater for sulphates than for nitrates. The heat of ionisation of the metal is also readily obtained, and the values agree well, as would be expected, with the heats of solution of the metals in dilute nitric or hydrochloric acid. L. M. J.

Electrical Conductivity of Salts dissolved in Glycerol. By Carlo Cattaneo (*Real. Accad. Lincei*, 1893, ii, 112—119).—In continuation of his work on the electrical conductivity of salts dissolved in water, alcohol, and ether (*Real. Accad. Torino*, 1893), the author has determined the conductivities of solutions of ammonium, sodium, zinc, barium, and ferric chlorides, and potassium bromide and iodide, in glycerol containing 2·5 per cent. of water, at various temperatures between 0° and 24°.

The conductivity of the various salts is, in general, greater than that of the corresponding ethereal solutions, but less than that of the alcoholic ones; the conductivity of the aqueous, alcoholic, and glycerol solutions increases more slowly than the concentration, but that of the ethereal solutions increases more rapidly than the concentration. As the concentration decreases, the molecular conductivity of the salts in aqueous solution increases, and in ethereal solution decreases; that of the chlorides increases, whilst that of the bromides and iodides decreases, in alcoholic solution, and in glycerol, the molecular conductivity of the chlorides increases whilst the concentration decreases. The temperature coefficients are usually greater for aqueous than for alcoholic solutions; in ether, they are of approximately the same order as in water, but are negative in sign, whilst, in glycerol, the temperature coefficients have very high values.

A table of the conductivities of the glycerol used at various temperatures is given, showing that it obeys the rule enunciated by Bartoli, which states that those carbon compounds which become most viscous on cooling are those whose conductivity increases most rapidly as the temperature rises. At 18°, the conductivity of the glycerol was found to be of the order of 10^{-12}. W. J. P.

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* These values are calculated from those of copper nitrate by aid of the known E.M.F. of Cu—Ag and Cu—Pb cells.

Absorption of Acid and Alkali from Solutions by Platinum Black. By CARL KELLNER (*Ann. Phys. Chem.*, 1895, [2], **57**, 79—90).—Kohlrausch observed that the conductivity of solutions of certain acids and bases decreases slowly when determined in vessels containing platinised electrodes, and that, if the solution is removed from the vessels, the electrodes washed several times with distilled water, and the conductivity then redetermined, it will be found to have returned to its original value. Neutral salt solutions do not exhibit this behaviour. The author has examined solutions of a number of acids and bases, and finds that the peculiarity here spoken of is due to an absorption of some of the acid or alkali by the platinum black of the platinised electrodes. The acid or alkali absorbed is given up again to distilled water, as is shown by the gradual rise in the conductivity of water placed in the resistance vessels after the acid or alkali has been removed. It is only in this way that the absorption by the electrodes can be determined, as the absolute quantities absorbed are too minute to be detected by the ordinary chemical tests. H. C.

Production of very Low Temperatures and Liquefaction of Gases. By C. LINDE (*Ann. Phys. Chem.*, 1895, [2], **57**, 328—332).—The gas at the temperature t_1 is brought in the compressor from the pressure p_1 to the pressure p_2, and then, after cooling by a water jacket, passes into the inner tube of the cooling apparatus, from which it issues through a throstle valve, the temperature undergoing, on expansion of the gas, a reduction of $t_2—t_3$. In the cooling apparatus, it has met, at the temperature t_3, with the reverse current of expanded gas passing through the outer tube of the apparatus. Temperature equilibrium is here established, and the gas, after traversing the outer tube of the cooling apparatus, returns to the compressor again with the pressure p_1 and temperature t_5. In this way, by successive compressions and expansions, the gas may be cooled until, on expansion, it partly liquefies, and with an apparatus of this kind liquid air has been obtained.

The author claims that the apparatus recently described by Dewar for liquefying air, is identical with the above (compare, however, Dewar, Proc., 1895, 221). H. C.

Dependence of the Specific Heat of Water on the Temperature. By KONRAD DIETERICI (*Ann. Phys. Chem.*, 1895, [2], **57**, 333—338).—If two quantities of water at different temperatures are mixed, and C_{hm} is the mean specific heat of water between the higher temperature and that of the mixture, and C_{nm} the mean specific heat between the lower temperature and that of the mixture, then

$$C_{hm} = aC_{nm}.$$

The specific heat has here no simple physical meaning, but is made up of the specific heat c at constant volume and the heat of expansion δ, and the equation may, therefore, be given in the form

$$c_{hm} + \delta_{hm} = a(c_{nm} + \delta_{nm}).$$

From the experiments of Baumgartner-Pfaundler, Münchhausen-Wüllner, Velten, and Lüdin, the author has calculated the specific heat at constant volume c as a function of the temperature, and so obtained the equation

$$c_t = c_0(1 - \alpha t - \beta t^2),$$

in which $\alpha = 0{\cdot}00062$, $\beta = 0{\cdot}0000042$, and $c_0 = 0{\cdot}9996$. The specific heat of water at constant pressure and at 0° is taken as unity. From the above it will be seen that the specific heat at constant volume decreases with rising temperature; δ, on the other hand, increases with the temperature, and the sum of the two quantities which gives the specific heat at constant pressure first decreases and then rises with increasing temperature. H. C.

The Thermal Expansion of Salt Solutions. By S. DE LANNOY (*Zeit. physikal. Chem.*, 1895, **18**, 442—472).—The dilatometric method is employed in preference to other methods, reasons for its adoption being given. The various corrections applied to the results are stated, and the possible error of the determinations estimated as 0·000088. This is probably of the order of the actual probable error, for, although above the mean value in the experimental work, it is apparently not unfrequently reached. The thermometers employed were compared with an air thermometer, and the various corrections for the exterior cooled portion of the tube, the alterations of the zero-point, &c., are applied to the readings. The dilatometers are stated to have been calibrated, but no mention is made of the method of calibration employed. The experimental observations are reproduced by the unsatisfactory method of two expansion formulæ of the form $1 + \alpha t + \beta t^2$, the one available below, the other above 40°, but in some cases one formula suffices for the complete range. The observed results and those given by the expansion formulæ appear to agree satisfactorily, but are not compared in the paper, where comparisons are given only between the calculated values and those obtained from curves. The solutions examined were those of ammonium nitrate, potassium ferrocyanide, potassium bromide, ammonium sulphate, zinc sulphate, sodium nitrate, lead nitrate, strontium nitrate, and magnesium sulphate at various concentrations, and complete tables are given showing the composition of the solution, the expansions observed, the expansion formulæ, density, and temperature of maximum density which, however, most probably has no real significance. The author postpones the discussion of the results. L. M. J.

Normal Boiling Tube. By GEORG W. A. KAHLBAUM (*Ber.*, 1896, **29**, 71—73).—The boiling column described by the author consists of an outer tube, which is fitted into the distilling vessel, and an inner tube, which communicates at its lower extremity with the condenser. The thermometer, which is placed in the inner tube, is thus surrounded by a double envelope of vapour, and is also screened from projected particles of liquid. M. O. F.

Boiling Point and the Genesis of the Elements. By CHARLES T. BLANSHARD (*Chem. News*, 1895, **72**, 299—301).—The differences in the boiling points of elements in various groups are compared with the differences in boiling points in various homologous series of carbon compounds. From the results, the author concludes that the elements of groups I to IV are less highly evolved than the other elements. D. A. L.

Phenomena observed at the Critical Point. By GIULIO ZAMBIASI (*Real. Accad. Lincei*, 1892, ii, 423—431).—The gaseous and liquid forms of a substance are supposed to have the same specific volumes at the critical temperature; this assumption was made by van der Waals in dealing with the continuity of the liquid and gaseous states. Cailletet found, however, that in the case of carbonic anhydride, the meniscus disappeared before the specific volumes of the liquid and gas became quite equal. The author has investigated the critical point of ether in the following manner. Ether is sealed in an annular tube containing mercury, in such a way that the mercury in the two arms is surmounted by unequal heights of ether; on very gradually and regularly raising the temperature of the tube to the critical temperature of ether, the mercury in the two arms of the tube should attain the same level at the instant the meniscus disappears. This, however, is not the case; the meniscus vanishes at about 193°, whilst the level of the mercury only becomes the same in the two arms at 196°. The temperature at which the meniscus disappears is, moreover, not constant; this may be clearly seen by heating a tube of which the two arms contain very different heights of ether, the meniscus may be caused to vanish several times in the one arm without the other meniscus being affected. The author concludes that the temperature at which the meniscus disappears is not constant for the same substance, but depends on the quantity of liquid employed.

W. J. P.

Disappearance of the Meniscus at the Critical Point. By GIULIO ZAMBIASI (*Real. Accad. Lincei*, 1893, i, 21—27).—The author has devised (see preceding abstract) a method by which it may be shown that the temperature of disappearance of the meniscus between a liquid and its vapour enclosed in a tube varies for the same substance. The temperature of disappearance rises as the ratio of the volume of liquid to that of the vapour decreases; the highest temperature at which the meniscus can be made to disappear is the critical temperature, and the substance is then in the critical state. The meniscus disappears at the critical temperature only when the substance has the critical volume, but vanishes below the critical temperature if the total volume is less than the critical volume and greater than the volume which the whole mass would occupy in the liquid state at the same temperature. To raise a substance to the critical state, it is necessary to heat such a quantity that at the critical temperature it will have the critical volume. By using the annular form of tube described by the author, furnished with a regulator of the volume, the substance is in the critical state when the meniscus between the liquid and vapour disappears at the same instant as the level of the mercury in the two arms becomes the same. The space occupied by the substance is then the critical volume, and the temperature and pressure are also the critical ones. W. J. P.

Gas and Vapour Density Determinations by means of a Pressure Balance. By MAX TOEPLER (*Ann. Phys. Chem.*, 1895, [2], **57**, 311—323).—A method is described for determining the density of a gas from the difference in pressure in two capillary tubes open to the atmosphere, one of which is filled with the gas in question and the other with air. H. C.

Extension of the Laws of Gay-Lussac and Avogadro to Homogeneous Liquids and Solid Substances. By ISIDOR TRAUBE (*Ber.*, 1895, **28**, 3292—3302).—In a number of previous communications (Abstr., 1895, ii, 70, 308; this vol., ii, 152), the author has shown that, for homogeneous liquids, the molecular volume

$$V_m = \Sigma nC + 25·9,$$

where ΣnC is the sum of the products of the numbers of atoms n_1, n_2, n_3, &c., and the atomic volumes C_1, C_2, C_3, &c., and the constant 25·9 is what has been termed the molecular dilatation, and is the same for all substances. For the same pressure and temperature, the molecular volumes of the gases are the same, or V = constant. But, when a gas is under a high pressure or near its point of condensation, as van der Waals has shown, the volume proper of the molecule can no longer be regarded as small in comparison with the intermediate spaces, as is the case with a perfect gas. Avogadro's law for the same temperature and external pressure then becomes

$$V - b = \text{const}.$$

where b is a simple function of the true molecular volume, the value of which, for the perfect gas, becomes zero. A comparison of this formula with that given above shows that the two, if not identical, would, at any rate, become so on sufficient condensation of the gas.

The quantity ΣnC denotes the true volume of the molecule in the narrow sense of the term, and the value of b should, according to theory, be four times the molecular volume; but, as van der Waals has pointed out, as the condensation of the gas increases the value of b diminishes, and, therefore, for liquids, this relationship cannot hold, as the assumption $v > b$ is no longer true. It may, therefore, be maintained that for liquids the constant b is nothing more than the true molecular volume, or ΣnC. The constant $V - \Sigma nC$ acquires, accordingly, a new meaning, and may be termed the "molecular co-volume," so that the observed molecular volume of any compound may be regarded as the sum of two quantities, the true molecular volume, or volume occupied by the molecule, and the molecular co-volume.

It will be seen from the above that Avogadro's law may be applied to both gases and liquids in the form of the general statement, that, under like conditions of temperature and pressure, the volumes in which the molecules are free to move are the same, or the molecular co-volumes are equal.

If Avogadro's law applies to the molecular co-volumes of liquids, the same should be true of Gay-Lussac's law, and the molecular co-volumes of different liquids should expand by equal amounts for the same rise in temperature. To test this conclusion, the author has calculated the molecular co-volumes at 0° and 100° for a number of the paraffinoïd hydrocarbons and for the ethereal salts of some of the fatty acids, these compounds being selected as the disturbing influence of molecular association in the liquid state is thus avoided. The coefficient of expansion, $\alpha = \frac{1}{\text{Cov.}_0} \frac{\text{Cov.}_{100} - \text{Cov.}_0}{100}$, is found to be approximately the same in all cases, and its mean value is 0·00366 or 1/273. It therefore appears that the molecular co-volumes of the liquids increase by 1/273 of their value for each degree rise of temperature, and, consequently, that the expansion of liquids like that of gases is proportional to the absolute temperature. The molecular co-volume at any temperature is 24·5 $(1 + 0{\cdot}00366\ t)$, or 0·090 T, the units being grams and cubic centimeters, t temperature in Centigrade degrees, and T the absolute temperature.

As the laws of Avogadro and Gay-Lussac hold for liquids, that of Boyle must, in consequence, be also true, but the present data are insufficient for direct proof. The author shows that there is reason to believe that in the above form these laws may be extended to solid substances, and that the molecular co-volumes are the same in both the liquid and solid states.

The passage from the solid to the liquid state is then unattended by any change in the molecular co-volume, but, in passing from the liquid to the gaseous condition, the molecular co-volume decreases, the decrease being the greater the higher the temperature. There will, therefore, be for every substance a particular temperature at which the molecular co-volumes of the liquid and the gas are the same. This is obviously the critical temperature. H. C.

Degree of Dissociation at Zero Temperature. By R. W. Wood (*Zeit. physikal. Chem.*, 1895, **18**, 521—523).—The values for the dissociation obtained by the freezing point method are usually lower than those obtained from the conductivity, and Wildermann has suggested that the differences are due to the fact that the conductivity is usually determined at a higher temperature, about 18° to 25°. The author, therefore, determined the conductivity of solutions of potassium chloride at 0°, and the values then obtained for the dissociation, although in almost complete accord with the numbers obtained by Kohlrausch at 18°, are considerably higher than those obtained from the freezing point by Wildermann. The author considers it most probable that, as yet, the freezing point depressions in very dilute solutions are not accurately known. L. M. J.

Determination of Molecular Weights. III. By Ernst Beckmann, Gotthold Fuchs, and Victor Gernhardt (*Zeit. physikal. Chem.*, 1895, **18**, 473—513; compare Abstr., 1895, ii, 154, 382).—According to Arrhenius' formula, the constant for the boiling point elevation is obtained by the equation $k = 0{\cdot}0198\ T^2/w$, where w is the latent heat of vaporisation of the solvent. This constant is, however, frequently unknown, but may be calculated from Clausius' formula $w = 1{\cdot}98\ T^2 \ .\ dp/dt \times 1/Mp$, the letters having their usual significance. Also, by Trouton's rules, which was found to be valid by Luginin and by Schiff (Abstr., 1895, ii, 154), the latent heat is given by the expression $T/M \times$ constant, the value of the constant varying in different series of compounds. These expressions were tested by the authors for a large number of liquids, the molecular elevation of the boiling point being determined directly and calculated from vapour pressure alteration experiments, as well as by Trouton's rule. The latent heat of vaporisation of the liquid was also calculated, both by the boiling point and vapour pressure determinations. The following liquids were investigated: benzene, cymene, carbon bisulphide, chloroform, methylic iodide, ethylic iodide, ethylic bromide, nitroethane, propionitrile, ethylenic dibromide, ethylenic dichloride; water, methylic, ethylic, propylic, isopropylic, isoamylic, and tertiary amylic alcohols; ether, methylal, methylic and ethylic formate and acetate, isoamylic acetate, paraldehyde, acetone, methyl propyl ketone, camphor, menthone, menthol, and glycerol. In most cases, Trouton's rule gives approximate results, whilst the calculated latent heats agree with one another and with the direct determinations as well as the latter agree among themselves. The values for the latent heat of water obtained by the two methods were 548·8 and 536·8.

L. M. J.

Boiling Points of Solutions of Salts in Methylic and Ethylic Alcohols. By J. Woelfer (*Ann. Phys. Chem.*, 1895, [2], **57**, 91—111).—The author has determined the boiling points of dilute solutions of the iodides and acetates of sodium and potassium, the chlorides of lithium and calcium, and the nitrates of silver and calcium in methylic and ethylic alcohols. The molecular weights of the dissolved substances were in each case calculated from the results by means of the formula

$$M = \frac{0{\cdot}02T^2}{r}\frac{g}{dT},$$

where r is the latent heat of vaporisation of the alcohol, T its boiling point in absolute temperature, dT the raising of the boiling point by the dissolved substance, and g the percentage of the dissolved substance contained in the solution. The calculated molecular weights were found to be almost invariably lower than the true values. They increase, however, with rising concentration, but, in the case of the methylic alcohol solutions, suffer a subsequent decrease when the concentration reaches a certain value. The maximum for the methylic alcohol solutions occurs when the molecular concentration is 0·302 per litre, or, in the case of calcium nitrate, about double this value. The dissociation calculated from the raising of the boiling point, in the case of the ethylic alcohol solutions, only agrees with that determined from the conductivity in the case of the very dilute solutions. In the more concentrated solutions, the dissociation calculated from the boiling points is smaller than that calculated from the conductivities. A better agreement is obtained with the solutions in methylic alcohol. The author's results are not in agreement with Ostwald's law of dilution.

H. C.

Use of Bromoform in Cryoscopy. By G. AMPOLA and C MANUELLI (*Gazzetta*, 1895, **25**, ii, 91—101).—Bromoform behaves somewhat similarly to benzene and paraxylene (compare Paternò and Montemartini, Abstr., 1895, ii, 207) when used as the solvent in molecular weight determinations by the cryoscopic method. According to Raoult's law, the molecular depression of the freezing point of bromoform should be 156·86; the mean of a number of determinations made with paraldehyde, benzene, naphthalene, paraxylene, thiophen, aniline, dimethylaniline, and quinoline give the value as 144. The substances named in the above list may be said to behave normally towards this solvent; ethylic oxalate gives depressions which are too low, whilst isobutyric and acetic acids, the only two acids studied, give molecular depressions of about half the normal values just as they do in benzene and paraxylene. The behaviour of phenols and alcohols in bromoform is also very similar to their behaviour in benzene and paraxylene; phenol and thymol give low molecular depressions, which decrease rapidly as the concentration increases, until, in a 9 per cent. solution, the molecular depression with phenol is only 53·6. The molecular depressions with ethylic and benzylic alcohols and trimethylcarbinol are low even in 0·5 per cent. solutions, and decrease as the concentration increases until, in a 15·8 per cent. solution, the molecular depression with ethylic alcohol is only 16·2. It is noteworthy that chloroform depresses the freezing point of bromoform normally. W. J. P.

Laws of Connection between the Conditions of a Chemical Change and its Amount. III. Further Researches on the Reaction of Hydrogen Dioxide and Hydrogen Iodide. By A. VERNON HARCOURT and WILLIAM ESSON (*Phil. Trans.*, 1895, **186**, 817—895. Bakerian Lecture).—The investigations commenced nearly 30 years ago by the authors (Trans., 1867, **20**, 460) on the reactions which take place between hydrogen dioxide and hydrogen iodide as a case of gradual chemical change, have been continued at intervals, and the results obtained are communicated in this paper. The vessel employed in making the observations consisted of a tall, glass cylinder, 12 × 3 inches, round which, about $2\frac{1}{2}$ inches from the top, a fine line had been etched. The cylinder was closed by a caoutchouc stopper, through which passed (1) an inverted funnel tube in the centre, (2) a thermometer, (3) a short tube, $1 \times \frac{1}{2}$ inch, giving access to the interior. Into the cylinder were poured water, and measured quantities of solutions of all the reacting substances except hydrogen dioxide; the temperature was brought to the desired degree; and more water was added until the upper surface of the liquid coincided with the line round the cylinder. Then a measure of hydrogen dioxide was brought in. Large bubbles of carbonic anhydride were sent through the liquid to act as a stirrer, the bubbles issuing at the bottom of the inverted funnel. Whenever the liquid, in which iodine was being slowly formed, showed the blue colour of iodised starch, drops of uniform size of a concentrated solution of sodium thiosulphate were brought in one at a time through the short tube. As soon as the small portion of thiosulphate, dissolved in each drop, was exhausted, the iodine liberated by the peroxide was no longer removed, the liquid became blue, and the moment of change was noted. Thus were observed the successive intervals required for the performance of a known fraction of the total change, and from these the rate of change was inferred. Such observations furnish the means of measuring the time required for a definite amount of chemical change under known conditions. The time required varies, because one condition is continually varying, namely, the amount of dioxide in the liquid.

If y is the amount of dioxide at a time t, y' at a time t', the relation connecting these quantities is

$$y' = ye^{-\alpha(t' - t)},$$

in which α is the fraction of the dioxide which disappears in a unit of time. Each observation furnishes a value of α, and the mean of the values obtained in this way from a set of observations is taken as the true value under the conditions of each experiment.

The substances used in most of the observations were (1) a solution containing hydrogen dioxide, made by dissolving sodium dioxide in a slight excess of dilute sulphuric acid; (2) a solution of potassium iodide or hydrogen iodide; (3) dilute sulphuric acid; of the last named, a relatively large quantity being generally taken. The quantities of each substance are stated as the number of millionth-gram molecules per c.c.

The first series of observations were made in order to ascertain the influence on the rate of change of variations in the amount of sulphuric acid. If i denotes the number of millionth-gram molecules of iodide and s the number of millionth-gram molecules of sulphuric acid in 1 c.c., the following three formulæ hold for the solutions examined at 30°

$$\alpha = i\{4730 + 18(s - 190{\cdot}5)\}10^{-6},$$
$$\alpha = i\{10550 + 22{\cdot}5(s - 514)\}10^{-6},$$
$$\alpha = i\{16130 + 26{\cdot}5(s - 762)\}10^{-6},$$

the first formula holding from $s = 190$ to $s = 514$, the second from $s = 514$ to $s = 762$, and the third from $s = 762$ to $s = 1143$. It appears from this that the increment in the rate of change due to each unit-substitution of sulphuric acid for water is constant until a certain ratio of acid to water is reached; at this point, the increment suddenly rises and remains constant until another ratio of acid to water is reached, after which it again rises and then remains constant as far as the experiments proceeded. These results accord with the view that when a drop of sulphuric acid is mixed with a relatively large volume of water, the liquid consists of a mixture of water with whatever hydrate of the acid contains the largest number of molecules of water. If the addition of acid is continued, the proportion of this first hydrate increases and the proportion of water diminishes, until a point is reached at which the liquid consists of the hydrate. After this point, a new order of events begins; a second hydrate is formed with a larger proportion of acid, its amount increasing and that of the first hydrate decreasing, until the liquid consists of the second hydrate. Then begins the formation of a third hydrate, and so on.

Sets of observations at the lower temperatures of 16° and 20°, also show that the value of the increment of rate, caused by successive replacements of water by sulphuric acid, changes abruptly at certain points. The results are consistent with the supposition that, at the three temperatures of the authors' experiments, the composition of the two hydrates indicated is the same. Their composition is probably not far removed from $H_2SO_4,106H_2O$ and $H_2SO_4,71H_2O$, and it may have some significance that these numbers are to one another in the ratio of 3 : 2. The rise of temperature of 14° augments the increment of the rate of change per unit of sulphuric acid in the ratio 2·62 : 1, whichever hydrate is being formed.

Separate investigations were made with the object of ascertaining the effect of the first additions of very small quantities of acid. The first small addition of sulphuric acid causes a much greater increment of the rate than subsequent small additions, and it is only when the proportion of acid reaches a certain limit that the first minimum and constant value of the coefficient of *s* appears

The influence of hydrogen chloride on the rate of change was next investigated. Putting i for the number of millionth-gram molecules of hydrogen iodide, and c for the number of millionth-gram molecules of hydrogen chloride, the equation which represents the variation of the rate with the amount of hydrogen chloride, at 30° and over the range of the observations, which were extended from $c = 71$ to $c = 355$, is

$$\alpha = i\{2800 + 16{\cdot}8(c - 71{\cdot}1)\}10^{-6}.$$

Comparing the influence on the rate of the presence of sulphuric acid and hydrogen chloride respectively, it will be seen that, molecule for molecule, the two acids are nearly equivalent, instead of one molecule of sulphuric acid being equivalent to two molecules of hydrogen chloride as in combining with bases.

An addition of hydrogen iodide, like an addition of hydrogen chloride or sulphuric acid, causes an increment in the rate. It is necessary in this case to separate the effect of the hydrogen iodide as one of the substances which is undergoing change from that of the hydrogen iodide as an acid; and when this is done, the numbers found are in arithmetical progression, and correspond with the previous series representing the accelerating effects of sulphuric acid and hydrogen chloride.

The effect of an addition of sodium hydrogen carbonate was also investigated, and here again the results obtained were similar to those given by the other substances examined.

Instead of varying the conditions of the change by taking more or less of some of the ingredients of the solution, it was possible to make a variation by substituting salts with the same metal or acid radicle, one for another, in the proportion of their molecular masses. The effect of substituting sodium for potassium iodide molecules is to increase the rate; a substitution of sodium for hydrogen chloride causes a decrease. The influence of sodium chloride on the rate, and doubtless that of other salts, is far greater in presence of sodium hydrogen carbonate than it is in presence of hydrogen chloride. A substitution of iodide for chloride, in molecular proportion, causes a retardation; but, absolutely, each salt accelerates.

The results obtained throughout do not seem to show any effect of progressive dilution beyond the necessary consequence that every addition of water diminishes proportionally the mass of each acid or salt in unit volume. If the hypothesis of ionic dissociation is accepted, it seems to follow that the acids and salts which have been the subject of these experiments are either (1) so near complete dissociation in solutions of normal strength that no great increase in the proportion of ions to molecules is caused by further dilution, or (2) that not much dissociation has yet taken place in solutions of less than centinormal strength, or (3) that the ions interact at the same rate, and accelerate chemical change in the same degree, as the molecules from which they are formed.

In order to study the effect of varying the temperature, the rates at different temperatures were compared when the change takes place with the same amounts of each substance in unit volume. A solution containing sulphuric acid and hydrogen iodide was selected for the purpose, and to facilitate the investigation of the law of connection between α and t, a calculation was made, by interpolation from the results, of the rates at degrees of temperature expressed in whole numbers and with successive differences of 5°. The observations extended from 0° to 50°, and the table is given of the values of α, their logarithms to the base 10, and the successive differences of the logarithms, $\Delta \log \alpha$. These last numbers continually diminish as the temperature increases, and as a first approximation may be assumed to be in arithmetical progression; so that we may put $\Delta \log \alpha_x = a - bx$. This formula, however, although convenient for calculating the rates at different temperatures ranging from 0° to 50° would fail for higher degrees of temperature.

A function of x, the successive differences of which closely resemble the successive differences of $\log \alpha$, is $u_x = \log (c + x)$, when c is considerably larger than x. Assuming that

$$\log \alpha_x = m \log \left(\frac{c + x}{c}\right) + \log \alpha_0 ,$$

the values of m and c may be found from the experimental numbers. If the value of x is taken as 5, that of c is found to be 54·52, or since $5x = t$,

$$\log \alpha_t = m \log \frac{272{\cdot}6 + t}{272{\cdot}6} + \log \alpha_0,$$

or

$$\frac{\alpha t}{\alpha_0} = \left(\frac{272{\cdot}6 + t}{272{\cdot}6}\right)^m .$$

This equation implies that no chemical change will take place when $t = -272{\cdot}6$, a temperature at once recognised as practically identical with that of the absolute zero. Thus, within the limits of experimental error, it may be assumed that the zero of chemical change coincides with the zero of absolute temperature. If we call the absolute temperature at the freezing point T_o, the equation of connection of the amount of chemical change with temperature may be written in the form

$$\frac{a_T}{a_{T_0}} = \left(\frac{T}{T_o}\right)^m.$$

The form of this equation shows that the relation between the amount of chemical change at a given temperature and the absolute temperature is independent of the units in which each of these quantities is measured. It is further shown in the paper that the number m, which remains constant in a series of experiments at different temperatures with the same kind of solution, varies with the nature of the main ingredient of the solution, but not with the amount of that ingredient. If a and a' are two rates corresponding with two temperatures very near to each other

$$\frac{a' - a}{a} \Big/ \frac{T' - T}{T} = m.$$

which implies that the increase of each unit of chemical change per unit increment of each unit of temperature is constant at all temperatures.

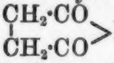
A large number of experimental confirmations of this law of the connection between chemical change and temperature are given in the paper. It is convenient to express the relation in the form

$$\log a - \log a_o = m(\log T - \log T_o).$$

This mode of stating the law has the advantage that the graphic representation is a straight line. H. C.

Stability of Imides of Dibasic Acids. By ARTURO MIOLATI (*Real. Accad. Lincei*, 1894, i, 515—521).—The imides of the dibasic acids are soluble in water, and are slowly decomposed by dilute hydrochloric acid at the ordinary temperature, so that they lend themselves readily to determinations of the velocity of reaction. The reaction is of the second order, and is therefore represented by the usual expression $Ac = x/t(A - x)$, the units being cubic centimetres and minutes. The determinations were made at 25° in 190 c.c. of N/190 solutions of the imide to which 10 c.c. of N/10 caustic soda was added; from this mixed N/200 solution, samples were drawn at definite intervals and the acid determined by titration. The velocity constants, Ac, for succinimide, pyrotartarimide, and glutarimide are 0·002382, 0·001374, and 0·2511 respectively.

It is seen that, by introducing a methyl group into succinimide, and so getting pyrotartarimide, the resistance to hydrolysis is greatly increased; by lengthening the methylene chain by one $—CH_2$ group, as in glutarimide, the velocity of decomposition becomes a hundred times greater than with the original succinimide. W. J. P.

Stability of Substituted Succinimides. By ARTURO MIOLATI and E. LONGO (*Real. Accad. Lincei*, 1894, i, 597—605).—Using the method previously described (see preceding abstract), the authors have determined the velocities of hydrolysis of a number of succinimides of the constitution  $\begin{matrix}CH_2\cdot CO\\ | \\ CH_2\cdot CO\end{matrix}>NR$, where R is an alkylic radicle; the velocity constants Ac are tabulated below.

R.	Ac.	R.	Ac.
H·	0·00238	$C_6H_5\cdot CH_2\cdot$	0·276
$CH_3\cdot CH_2\cdot CH_2\cdot$	0·05500	$CH_2:CH\cdot CH_2\cdot$	0·282
Et·	0·08500	C_6H_4Me (para)·	1·120
Me·	0·21700	$C_6H_5\cdot$	2·270

The substances are arranged in order of stability, and, as will be seen, are very much more readily hydrolysed than the unsubstituted succinimide. W. J. P.

Reaction Velocity of Intramolecular Changes in Stereoisomeric Oximes. By HEINRICH LEY (*Zeit. physikal. Chem.*, 1895, **18**, 376—398).—The first change studied was that from the synaldoxime acetate to the corresponding nitrile and acetic acid. The observations were made at temperatures varying from 25° to 70° in the case of the acetates of thiophen-synaldoxime, anis-syn-aldoxime, benz-syn-aldoxime, parachlor-, parabrom-, and pariodo-benz-synaldoximes, the compounds being enumerated in the order of magnitude of the reaction constants, which vary from 0·00041 to 0·0007 at 25°, and 0·00296 to 0·012 at 50°, the reaction being of the first order. The results are also shown by curves, in which a specific influence of the thiophen group is evident, the curve for its derivative falling apart from the rest. The temperature influence agrees fairly satisfactorily with van't Hoff's formula, $K_t = K_o \,.\, e^{a\frac{T_1 - T_0}{T_1 \,.\, T_0}}$.

The next change considered was the intramolecular change from the syn-aldoxime to the anti-aldoxime in alcoholic hydrogen chloride solution. This was done in the case of the benzaldoxime, anisaldoxime, and *p*-chloraldoxime acetates, at temperatures varying from 10° to 40°. The constant was greatest for benzaldoxime, C_{10° = 0·0148, and least for anisaldoxime, C_{10° = 0·0075, whilst the temperature change is as indicated theoretically.

In this case, the thiophen derivative could not be examined, as, under the conditions of the experiments, the nitrile is produced.

L. M. J.

Action of Unorganised Ferments. By GUSTAV TAMMAN (*Zeit. physikal. Chem.*, 1895, **18**, 426—442).—The enzymes differ from inorganic hydrolytic agents in exerting a special, and not a general, action, and also in their loss of activity during the progress of the action. Hence, of two reactions with equal initial velocities, that caused by an enzyme progresses more slowly than that caused by an acid, &c. For the study of this loss of activity, the decomposition of salicin by emulsin was investigated.

Other conditions being similar, the quantity of salicin decomposed in a given time was found to be dependent on, and could be employed as a measure of, the quantity of emulsin present. Emulsin was then dissolved in water, and, from time to time, equal quantities were withdrawn, and the quantity of the active enzyme measured by salicin, as indicated above. At temperatures above 50°, the loss of activity of the emulsin appears to be due to a unimolecular reaction, since the value $1/t \, . \log 100/(100 - x)$ remains approximately constant, where $100 - x$ is the percentage of active enzyme found in the solution after a given time t; at temperatures below 50°, however, this expression did not lead to a constant value. The loss of activity of solid emulsin was also determined at temperatures between 80° and 108°, the reaction being again of the first order. The reaction velocity for the decomposition of salicin diminishes, therefore, but the measurement of the initial velocities at 25° and 40° agree well with those calculated from the initial velocity at 0°. The decomposition cannot be complete, but must tend towards a definite limit, which is a function of the original quantities of both salicin and emulsin, varying, from 0 to 1 when the quantity of ferment varies from 0 to 8, and the validity of this deduction is proved experimentally. L. M. J.

Molecular Symmetry and Asymmetry. By ALBERT LADENBURG (*Ber.*, 1895, **28**, 3104—3105; compare Abstr., 1895, ii, 489).—A reply to Groth (this vol., ii, 159). M. O. F.

The so-called Liebig's Condenser. By GEORG W. A. KAHLBAUM (*Ber.*, 1896, **29**, 69—71).—The form of apparatus in general use is a modification of the condenser originally described by Weigel in the year 1771. Liebig simply referred to it (*Handbuch Chem.*, 1843) as a known form, having many advantages. M. O. F.

Modification of Mohr's Balance, and a Simple Apparatus for Measuring the Volumes of Solids. By GIOVANNI GUGLIELMO (*Real. Accad. Lincei*, 1894, ii, 299—303).—The author describes a modification of Mohr's balance for determining densities. The volume of a solid can be determined within 0·01 c.c. by measuring with a burette the volume of water which it displaces from a beaker, the edge of which is ground, and which is furnished with a glass or platinum pointer, terminating in the plane of the edge of the beaker. W. J. P.

Inorganic Chemistry.

Ratio of the Atomic Weights of Oxygen and Hydrogen. By JULIUS THOMSEN (*Zeit. anorg. Chem.*, 1895, **11**, 14—30; see also Abstr., 1894, ii, 277).—The method employed consisted in determining the weight of hydrogen evolved by dissolving a known weight of pure aluminium in sodium hydroxide in a specially constructed apparatus; the weight of hydrogen being determined by the difference in weight before and after the dissolution of the aluminium. Also, in a similar apparatus, by determining the increase in weight brought about by burning the evolved hydrogen in pure oxygen. Drawings and a full description of the apparatus employed are given in the original paper. The mean of 21 experiments, in which altogether 162·3705 grams of aluminium were used and 18·1778 grams of hydrogen evolved, gave hydrogen/aluminium = 0·11190 ± 0·000015, and the mean of 11 experiments in which 86·9358 grams of aluminium was used and 77·1876 grams of oxygen, gave oxygen/aluminium = 0·88787 ± 0·000018. Whence O : H = 15·8690 ± 0·0022. Or when O = 16, the atomic weight of hydrogen is 1·008255, and the molecular weight of water is 18·0165. These results agree very closely with the recent determinations by other experimenters. E. C. R.

Origin of Atmospheric Oxygen. By Thomas L. Phipson (*Compt. rend.*, **121**, 719—721).—See this vol., ii, 265.

Decomposition of some Trinitrides. By Alberto Peratoner and Giuseppe Oddo (*Gazzetta*, 1895, **25**, ii, 13—21).—The molecular weight of argon, 40, approximating to that of a triatomic polymeride of nitrogen, the authors have made a number of experiments on the gas obtained by the decomposition of azoimide and its derivatives, and find that argon is in no case obtained.

During the electrolysis of sodium azoimide solutions, nitrogen and hydrogen are at first evolved in the proportion of 3 : 1, but as the quantity of salt decreases, oxygen and nitrogen collect at the positive pole, although not in quantities equivalent to the hydrogen separated at the negative pole, owing to oxidation of the nitrogen to nitric acid. The same behaviour is observed in the electrolysis of aqueous azoimide; ammonia, but no hydrazine, is found in the residual solution. The irregularities observed by Hittorf during the electrolysis of trinitrides are due to the occurrence of secondary reactions such as are here indicated. The nitrogen obtained on exploding silver trinitride by heat in a special apparatus, and that evolved during the hydrolysis of paranitrotriazobenzene were also examined. The densities of the various samples of gas obtained in these experiments were determined and the gas was sparked after mixing with oxygen; in no case, however, was argon detected or evidence obtained of the existence of the polymeride N_3—N_3, corresponding with the azoimide radicle. W. J. P.

Argon. By Raffaelo Nasini (*Gazzetta*, 1895, **25**, i, 37—46).—The author contends that if the ratio of the two specific heats of an elementary gas such as argon approximates to 1·67, this fact can only be used as confirmatory evidence of the probable monatomicity of the molecules, but cannot be accepted as authoritative and conclusive evidence, if no other facts pointing to the same conclusion are forthcoming. The values of *k* for all the polyatomic gases are considerably less than 1·67, but the values for the diatomic gases are not all the same, indicating that the approximation to sphericity of the molecules, or the magnitudes of the intermolecular movements, or both, have different values for different gases; it is thus quite possible that the molecules of argon are diatomic, but so nearly spherical, and possessed of so little internal movement that the value of *k* is almost that of a monatomic gas. If argon is monatomic, it has an atomic weight of about 40, and finds no place in the recognised periodic classification; if, as seems more probable, it is diatomic and has an atomic weight of about 20, between those of fluorine and sodium, it finds a suitable place in the periodic system as the first member of a new series of elements lying between the series of the halogens and of the alkali metals. W. J. P.

Solubility of Silica. By ARTHUR M. EDWARDS (*Chem. News*, 1896, **73**, 13).—The siliceous shells of *Bacilliariaceæ*, *Spongidæ*, and *Radiolariæ*, in infusorial earth and soundings are observed to dissolve in fresh spring water, probably from its containing ammonia.

D. A. L.

Italian and other Cements. By GIUSEPPE ODDO and E. MANZELLA (*Gazetta*, 1895, **25**, ii, 101—113).—The authors have made analyses and resistance tests of a number of hydraulic, Roman and Portland cements of Italian, German, and French origin; the percentage compositions of the Italian cements are not very different from those of the other samples examined. The mean composition of the slowly setting cements in percentages is 61·14 CaO, 1·05 MgO, 20·94 SiO_2, 9·26 Al_2O_3, and 1·5 Fe_2O_3, whilst that of the rapidly setting samples is 57·67 CaO, 0·90 MgO, 21·97 SiO_2, 9·91 Al_2O_3. and 1·46 Fe_2O_3. The molecular compositions of the slowly and rapidly setting cements are respectively

$$\frac{2{\cdot}183\ \mathrm{CaO} + 0{\cdot}052\ \mathrm{MgO}}{0{\cdot}070\ \mathrm{SiO_2} + 0{\cdot}182\ \mathrm{Al_2O_3} + 0{\cdot}019\ \mathrm{Fe_2O_3}} = 2{\cdot}481$$

and

$$\frac{2{\cdot}060\ \mathrm{CaO} + 0{\cdot}045\ \mathrm{MgO}}{0{\cdot}0732\ \mathrm{SiO_2} + 0{\cdot}194\ \mathrm{Al_2O_3} + 0{\cdot}019\ \mathrm{Fe_2O_3}} = 2{\cdot}227.$$

The ratios of numerator to denominator are the molecular ratios of basic to acid radicles present, and are considerably lower than the values found by Le Chatelier. W. J. P.

The Setting of Cements. By GIUSEPPE ODDO and E. MANZELLA (*Gazzetta*, 1895, **25**, ii, 113—127; compare preceding abstract).—Although no noteworthy difference in composition exists between Italian and other cements, there is a very appreciable difference between the behaviour of the two classes of cements towards potassium carbonate. Samples of powdered cements, before and after setting, were extracted for definite times with potassium carbonate solution, using a special form of mechanical agitator, samples of the solution being drawn off at definite intervals, and the total and caustic alkalinity determined. The caustic alkali extracted from the French and German samples of unset cements practically reached a maximum within the first half hour; after setting, however, a much larger quantity of caustic alkali was extracted and the quantity increased continually as the time of extraction was increased to 9 hours. It is concluded that before the setting of these cements they contain but small quantities of free lime and readily decomposable polysalts; the quantity of these salts, which are slowly and continuously decomposed by potassium carbonate, is much greater after the setting.

Most of the Italian cements contain considerable quantities of lime before setting, and it is concluded that the setting is due to hydration of the salts present, for the amount of caustic alkali extracted by the potassium carbonate solution is not appreciably greater, and sometimes less, after setting, and frequently decreases as the time of extraction is increased. W. J. P.

Manufacture and Commercial Separation of Beryllium. By HENRY N. WARREN (*Chem. News*, 1895, **72**, 310—311).—Pulverised and lixiviated emerald is fused for 3 hours in a blast furnace, with four times its weight of sodium carbonate; the solidified mass is decomposed by superheated steam, and then by hydrochloric acid; evaporated to dryness, extracted with water, and the silica separated. The solution, freed from iron and chromium by the acetate method, is first treated with excess of sodium carbonate, and the precipitate heated with excess of sulphurous acid, when the alumina and glucina pass into solution; on boiling, the alumina is precipitated in a granular form, that can be readily washed; excess of ammonium carbonate is then added to the solution, which is well boiled. The precipitate of beryllium carbonate thus obtained is ignited with lampblack out of contact with the air, and then submitted to the action of bromine vapour at a full red heat in clay retorts. Beryllium bromide distils over, and is reduced electrolytically. D. A. L.

Sulphur and Carbon in Zinc. By ROBERT FUNK (*Ber.*, 1895, **28**, 3129—3132; compare Abstr., 1895, ii, 390).—The purified zinc of commerce usually contains traces of sulphur and carbon, which are not, however, dissolved in the metal, and may, therefore, be removed from the fused zinc by filtration through asbestos; the odour of the gas evolved by the action of zinc on sulphuric acid is due to the presence of hydrogen sulphide. (Compare this vol., ii, 274). M. O. F.

Orthoplumbates of the Alkaline Earths. By GEORG KASSNER (*Arch. Pharm.*, 1895, **233**, 501—507).—Calcium orthoplumbate, $Ca_2PbO_4 + 4H_2O$ (Abstr., 1895, ii, 14) loses $3H_2O$ at 240—250°, and is converted into a mixture of *calcium metaplumbate*, $CaPbO_3$, and hydroxide, although at a higher temperature (500°) these two substances condense again to the orthoplumbate. Calcium metaplumbate, on ignition, is converted into the orthoplumbate, lead monoxide, and oxygen. Anhydrous calcium metaplumbate is a chocolate brown powder, which, after long contact with water, absorbs $2H_2O$, and assumes a lighter hue.

Calcium diplumbate (*loc. cit.*), $CaH_2Pb_2O_6$, loses half its water at

310°, and the remainder at 380—400°. The intermediate product, *calcium tetraplumbate*, $Ca_2H_2Pb_4O_{11}$, is a loose yellowish powder.

JN. W.

Metaplumbates of the Alkaline Earths. By BRUNO GRÜTZNER and M. HÖHNEL (*Arch. Pharm.*, 1895, **233**, 512—521).—Calcium metaplumbate (preceding abstract) may be prepared by digesting the orthoplumbate with sodium peroxide and water; it is a white powder, crystallising in microscopic cubes. The analyses point to its containing $4H_2O$. A less pure product may be obtained by substituting caustic alkali for the alkali peroxide.

Silver metaplumbate, obtained by digesting calcium metaplumbate with aqueous silver nitrate at the ordinary temperature, is a dark gray, silky powder, crystallising in microscopic cubes. The crude product contains silver oxide, which can be dissolved out with ammonia; the product thus purified is of a clear gray colour, and its composition corresponds with the formula Ag_2PbO_3.

The barium and strontium salts cannot be prepared by the above methods.

JN. W.

Thallous Fluoroxymolybdate and Fluoroxyhypomolybdate. By FRANCESCO MAURO (*Real. Accad. Lincei*, 1893, ii, 382—384; compare Abstr., 1893, i, 124).—Delafontaine first prepared thallous fluoroxymolybate, $2TlF,MoO_2F_2$, by dissolving thallous oxide and molybdic anhydride in dilute hydrofluoric acid, but made the erroneous statement that it contains water of crystallisation; it is sparingly soluble in water and forms long, orthorhombic crystals which lose their transparency after a time; $a:b:c = 0{\cdot}85521:1:1{\cdot}02474$.

Thallous fluoroxyhypomolybdate, $2TlF,MoOF_2$, is prepared by electrolysing a solution of molybdic anhydride in hydrofluoric acid, covered with a layer of petroleum, and adding thallous oxide until the solution is decolorised. The deposited salt crystallises in vitreous, green, orthorhombic plates or prisms; $a:b:c = 0{\cdot}86595:1:1{\cdot}02952$.

Monothallous fluoroxymolybate, TlF,MoO_2F_2, which is deposited on concentrating a hydrofluoric acid solution of thallous fluoroxymolybdate over sulphuric acid, crystallises in lustrous, yellow, monoclinic plates which begin to decompose at 240°;

$$a:b:c = 0{\cdot}61985:1:1{\cdot}39755. \quad \beta = 86°\ 7'.$$

It was found by Scacchi (*Real. Accad. Lincei*, 1893, ii, 401) to be isomorphous with monammonium fluoroxymolybdate.

W. J. P.

Action of Phenol on Mercurous Iodide. By MAURICE FRANÇOIS (*Compt. rend.*, 1895, **121**, 768—770).—Mercuric iodide dissolves somewhat readily in hot phenol and separates in the yellow modification, which only slowly changes into the red form.

Boiling phenol decomposes mercurous iodide into the mercuric salt, which dissolves, and mercury which remains undissolved. The decomposition is however limited, and equilibrium is established when the phenol contains 2·75 parts of mercuric iodide in 100. A solution containing a higher proportion of mercuric iodide will attack mercury with formation of the mercurous salt, this action continuing in presence of excess of mercury, until the proportion of mercuric iodide in solution is reduced to 2·75 parts in 100°. Mercurous iodide is only very slightly soluble in boiling phenol in presence of sufficient mercuric iodide to prevent decomposition, but the mercurous iodide which has been heated to 100° in presence of phenol is converted into very distinct though microscopic crystals. (Compare this vol. i, 22). C. H. B.

Probable New Element in Terbia. By Paul Lecoq de Boisbaudran (*Compt. rend.*, 1895, **121**, 709).—A deep red-brown terbia when dissolved in hydrochloric acid showed only a faint absorption spectrum of dysprosium, and a nebulous band at λ487·7 which does not coincide with any known band, but seems to belong to a new element which the author distinguishes as Zδ. C. H. B.

Manganese Silicide. By Vigouroux (*Compt. rend.*, 1895, **121**, 771—773).—Manganese silicide, $SiMn_2$, is obtained (1) by heating silicon with nine times its weight of manganese in the electric furnace and treating the product first with water, then with dilute hydrochloric acid, and finally, and rapidly, with dilute hydrofluoric acid, or (2) by heating in the electric furnace a mixture of 1 part of silica, 3 parts of manganoso-manganic oxide, and 1 part of sugar-carbon, and treating the product as above, or better, (3) by heating silicon with 4 or 5 times its weight of manganoso-manganic oxide in a porcelain dish in an atmosphere of dry hydrogen up to the softening point of porcelain.

It has a metallic lustre and a steel-grey colour, is very hard and very brittle, and perfectly crystallised; sp. gr. = 6·6 at 15°. It does not alter when exposed to air, and melts at the temperature of the reverberatory furnace. Fluorine attacks it at the ordinary temperature, chlorine at about 500°, and iodine and bromine at higher temperatures; oxygen and air attack it at a red heat. Dry hydrogen fluoride decomposes it readily, especially if gently heated, hydrogen chloride below a red heat, and hydrogen iodide at a higher temperature; water is without action at 100°, but at a red heat decomposes the silicide, with liberation of hydrogen. Dilute acids attack it readily, and concentrated acids, especially hydrofluoric acid, are violent in their action; aqueous potash is without effect, but the solid substance attacks the finely powdered silicide when heated with it, and fused alkali carbonates or mixtures of carbonate and nitrate oxidise it readily. C. H. B.

Electro-dissolution and its Uses. By Henry N. Warren (*Chem. News*, 1896, **73**, 37—38).—When iron containing boron, silicon, sulphur, phosphorous or carbon is the positive electrode, platinum being the negative in a bath of sulphuric acid, the iron dissolves, whilst the impurities are wholly or partly precipitated. With impure copper in a hydrochloric acid bath, the copper is precipitated on the platinum, whilst the impurities—arsenic, iron zinc, &c., remain in solution. Stannic nitrate, potassium ferrate, and ferric acetate may be prepared by electro-dissolution.

D. A. L.

Hydrolytic Decomposition of Ferric Chloride. By Ubaldo Antony and G. Giglio (*Gazzetta*, 1895, **25**, ii, 1—12).—Freshly prepared and perfectly neutral ferric chloride solutions were made by digesting precipitated ferric hydroxide with dilute hydrochloric acid in the cold, filtering from the excess of ferric hydroxide, and subsequently adding the requisite quantity of hydrochloric acid to give a pure solution of $FeCl_3$. Those which contain less than 1·1 per cent. of the salt appear colourless in a 40 centimetre tube, but after several hours become yellow, the colour increasing in intensity during 48 hours after preparation. Dilute solutions, which have been preserved for some days, only slowly give a blue colour with ferrocyanide, whilst a solution containing only 0·00083 per cent. of ferric chloride gives no colour with ferrocyanide. From these results, and from the behaviour of the solutions towards sodium chloride and hydrogen sulphide, it is concluded that the ferric chloride reacts with the water, being converted in infinitely dilute solutions, or those containing less than 0·00083 per cent., into colloïdal ferric hydroxide, which is not acted on by potassium ferrocyanide; it is further shown by colorimetric measurements that the velocity of the reactions does not stand in simple relation to the concentration of the solution, so that it must be assumed that the hydrolysis leads to the formation of intermediate products, like $FeCl_2(OH)$ and $FeCl(OH)_2$. In the more concentrated solutions, a stable equilibrium is set up between these basic compounds and the other constituents of the solution; this equilibrium is destroyed by the addition of ferrocyanide, which only reacts with the ferric chloride, thus causing the hydroxy-chlorides to be acted on by the acid present, again yielding ferric chloride. W. J. P.

Salts of Ferric acid. By Ludwig Moeser (*Arch. Pharm.*, 1895, **233**, 521—527).—Potassium ferrate is best prepared by gradually adding bromine (50 grams) to ferric hydroxide (80—90 grams) suspended in a cooled concentrated caustic potash (50 grams in 80 grams of water); more potash is then added, and the mixture warmed and kept at 50—60° for half an hour. The cooled ferrate is drained on a tile, and the excess of alkali removed by alcohol; the potassium bromide is then removed by dissolving the product in a little water and reprecipitating it with alcohol. Potassium ferrate is a reddish-black powder, very soluble in water, forming a deep red solution. When ignited, it loses oxygen, and is converted into the green ferrite, which, unlike it, is very deliquescent, and rapidly oxidises to potassium and ferric hydroxides when exposed to air. Potassium ferrate is converted by alkali sulphides into a green substance, possibly a sulphoferrate.

Barium ferrate is obtained as a dark crimson, amorphous powder by precipitating potassium ferrate with barium chloride. It is also prepared by boiling freshly precipitated ferric hydroxide with baryta water and an appropriate oxidising agent, such as barium hypochlorite. Barium ferrate, on ignition, is decomposed into barium ferrite, water, and oxygen, and is violently acted on by acids, evolving oxygen, and yielding barium and ferric hydroxides; if nitric or sulphuric acid is used, the oxygen contains much ozone. Barium ferrate may be reconverted into an alkali ferrate by digestion with the alkali carbonate, and in this way *rubidium* and *cæsium ferrates* may be obtained. JN. W.

Platosomonodiamine Compounds. By ALFONSO COSSA (*Real. Accad. Lincei*, 1894, ii, 360—362).—On heating aqueous platosodiamine chloride with hydrochloric acid for some hours, platososemidiamine chloride separates; on adding potassium platinosochloride to the filtrate, the undecomposed platosodiamine chloride is immediately deposited as Magnus' green salt, and after filtering and concentrating the solution, platosomonodiamine platinosochloride, $2Pt(NH_3)_3Cl_2,PtCl_2$, separates in uniaxial, red laminæ of somewhat metallic lustre. It is dissolved by ammonia, with formation of platosodiamine chloride, and with nitric acid yields *chloroplatinomonodiamine nitrate*, which is colourless, and very insoluble in water.

Platosomonodiamine chloride is best prepared by adding the equivalent proportion of platosodiamine chloride to the platinosochloride; on concentrating the solution, Magnus' green salt separates, and on evaporating the filtrate a residue of *platosomonodiamine chloride* is obtained; this crystallises in colourless, monoclinic prisms, and is very soluble in water. W. J. P.

Mineralogical Chemistry.

Platinum, Pickeringite, and Magnesia zinc alum from N.S.W. By GEORGE W. CARD (*Records Geol. Survey, N.S. W.*, 1895, **4**, 130—134).—*Platinum* as grains from the alluvial gold works of Fifield, Forbes, gave, on analysis by J. C. H. Mingaye,

Pt.	Ir.	Rh.	Pd.	Osmiridium.	Fe.	Cu.
75·90	1·30	1·30	trace	9·30	10·15	0·41

Au.	Pb.	Insoluble.	Total.
nil	trace	1·12	99·48

Pickeringite, occurring as silky, acicular crystals at Mt. Victoria, gave

H_2O.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.
37·23	10·65	1·27	trace	nil	2·38	0·74

Na_2O.	SO_3.	Insol. (sand).	Total.
trace	30·28	17·89	100·44

The magnesia is too low for pickeringite.

Magnesia zinc alum, from New England, gave

Al_2O_3.	FeO.	ZnO.	CuO.	MgO.	Na_2O.	K_2O.	SO_3.	P_2O_5.	Insol.	H_2O [diff.].
9·36	trace	3·34	trace	5·78	0·60	trace	34·62	0·28	2·51	[43·51]

L. J. S.

Analyses of Gold, Meerschaum, Amber, and Magnetite from Servia. By Sima M. Lozanić (Losanitsch) (*Ann. Géol. Pénins. Balkan.*, 1893, **4**, (2), 81—86).—Gold from Slatina gave, Au 89·39; Ag 9·20; sand, traces; = 98·59. Meerschaum from Zlatibor gave

SiO_2.	MgO.	FeO.	Loss on ignition.	Total.
53·89	22·83	0·88	22·20	99·80

Amber from Vranješ, Kraljevo, of hardness 2—2·5, sp. gr. 1·081, gave C, 78·16; H, 10·13; O, 11·71 = 100·00.

Analyses, mainly technical, are given of various ores and coals; the following is of magnetite from Venčac.

Insol.	Fe_2O_3.	FeO.	Cr_2O_3.	Al_2O_3.	MgO.	Loss on ignition.	Total.
11·68	60·34	7·92	4·49	4·44	5·44	5·46	99·77

L. J. S.

Analyses of Austrian Minerals, &c. By Conrad von John and C. F. Eichleiter (*Jahrb. k. k. geol. Reichsanst., Wien*, 1895, **45**, 1—28).—Numerous analyses, mainly technical, are given of coals, ores and impure minerals, rocks, mineral waters, and some artificial alloys.

L. J. S.

Vanadiferous Coal from Peru. By Torrico y Meca (*Berg- und hütt. Zeit.*, 1895, 361; from *Boletin de Minas*, 1894, December 31).—This coal, from Yauli, resembling anthracite in appearance, was examined for platinum, but with a negative result. One sample gave 1·2 per cent. of a greenish-yellow ash, which contained 38 per cent. of vanadic acid; the blue sulphuric acid solution contained, besides vanadium, small quantities of alumina, lime, and magnesia, and a little nickel. Molybdic and tungstic acids were not found.

L. J. S.

Burmite, a New Amber-like Resin from Upper Burma. By Otto Helm (*Records Geol. Survey, India*, 1892, **25**, 180—181; 1893, **26**, 61—64; and *Schriften Ges. Danzig*, 1894, **8**, 63—66).—This new fossil resin is semi-transparent, and varies in colour from pale yellow to reddish and dirty brown, whilst some specimens are ruby-red and transparent; it shows a fine blue fluorescence. The shiny conchoidal fracture has a greasy touch. The darker, clouded specimens, of slightly higher specific gravity, enclose particles of organic matter and veins of calcite. A brown, weathered crust is usually present. The hardness of 2·5—3 is slightly higher than that of Baltic amber (succinite); sp. gr. 1·030—1·095. By dry distillation, it decomposes without fusion, yielding white aromatic fumes, a brownish-yellow oil, and a little watery liquid, the latter containing formic acid and probably pyrogallol. Analysis gave

C.	H.	O.	S.	Total.
80·05	11·50	8·43	0·02	100·00

The ash in a pure piece amounted to 0·2 per cent., and consisted of calcium sulphate and carbonate and ferric oxide; an impure specimen gave 4·6 per cent. of ash. It is very resistant to solvents; oil of turpentine dissolving 18·5 per cent., other solvents much less; it is gradually dissolved by concentrated sulphuric acid, yielding a red-brown solution. Burmite is distinguished from the Baltic succinite by the absence of succinic acid; from the Sicilian simetite by its resistance to solvents; and from the Auckland ambrite by its low percentage of oxygen and smaller solubility in carbon bisulphide.

The name burmite was first proposed by F. Noetling (*Records Geol. Survey, India*, 1893, **26**, 31), who describes the mode of occurrence and mining of the mineral near Maingkhwan, in the Hukong Valley.

L. J. S.

Composition and Constitution of Cubanite (Cupropyrite). By R. Schneider (*J. pr. Chem.*, 1895, [2], **52**, 555—559).—The author's analyses of this mineral are in accord with the empirical formula $CuFe_2S_3$, and agree with those of Scheidhauer (*Ann. Phys. Chem.*, 1845, **64**, 280). If the rational formula be

$$Cu_2S,FeS,FeS,FeS\}FeS_2,$$

the mineral may be regarded as the analogue of sternbergite, $Ag_2S,FeS,FeS,FeS\}FeS_2$, and of a number of sulpho-salts, which the author has from time to time described, of the general form $X''S,X''S,X''S,X''S\}Z^{iv}S_2$ where X is a bivalent group or element, and Z a quadrivalent group or element. Several examples are quoted.

A. G. B.

Artificial Precious Opal. By Giuseppe Cesàro (*Jahrb. f. Min.*, 1895, ii, Ref. 8; from *Bull. Acad. Belg.*, 1893, [3], **26**, 721—730).—A glass flask, which had contained hydrofluosilicic acid for several years, was coated with a white, translucent, opal-like deposit; this showed a play of colours, and had the composition $3SiO_2.H_2O$. Sodium and calcium silicofluorides were also formed by the action of the acid on the glass.

L. J. S.

Emery from Naxos. By Gustav Tschermak (*Tsch. Min. Mitth.*, 1894, **14**, 311—342).—The emery of Naxos, an island in the Grecian Archipelago, occurs as lenticular masses in the granular limestone associated with gneiss and schist; it consists, as seen in thin sections, principally of corundum and magnetite, with a little secondary hæmatite and limonite, and some margarite, tourmaline, muscovite, chloritoid, diaspore, and, less frequently, kyanite, staurolite, biotite, rutile, spinel, idocrase, and pyrites. There is a more or less banded structure marked out by layers of the iron ore. The corundum is mostly as rounded grains, but sometimes as crystals when surrounded by magnetite, and it is rich in enclosures, principally of magnetite. Analyses by E. Ludwig gave I for quality A from Kremnó, and II for quality B from Kenidi.

	SiO_2.	B_2O_3.	Al_2O_3.	Fe_2O_3.	MgO.	CaO.	Na_2O.	K_2O.
I.	5·64	1·15	57·67	33·36	0·83	0·43	n.d.	0·31
II.	5·45	0·88	56·52	34·65	0·43	0·90	0·60	0·40

	TiO_2.	CO_2.	Loss on ignition.	Total.
I.	n.d.	—	0·70	100·09
II.	n.d.	n.d.	0·42	100·25

From these analyses is calculated

	Corundum.	Magnetite.	Tourmaline.	Chloritoid.	Muscovite.	Margarite.	Calcite.
I.	52·4	32·1	11·5	—	2	2	—
II.	50	33	9	4	3	—	1

The emery of each deposit is described in detail. The sp. gr. varies from 3·71 to 4·07.
L. J. S.

Magnetite from the Madras Presidency, containing Manganese and Aluminium. By THOMAS H. HOLLAND (*Records Geol. Survey, India*, 1893, **26**, 164—165).—A granular specimen of magnetite, with a distinct reddish streak, and sp. gr. 5·045, from the Kodúr mines, Vizagapatam district, gave, on analysis,

Moisture below 105°.	H_2O on ignition.	Insol. in HCl.	Al_2O_3.	Fe_3O_4.	Mn_3O_4.	Total.
0·14	2·18	0·11	2·52	91·62	3·00	99·57

L. J. S.

Artificial Hæmatite and Magnetite. By WILHELM MÜLLER (*Zeit. deutsch. geol. Ges.*, 1893, **45**, 63—68).—The residue obtained on reducing nitrobenzene to aniline by means of iron and hydrochloric acid is allowed to stand in heaps before being smelted at Laar, near Ruhrort. Owing to the energetic oxidation of the ferrous chloride, there is a considerable rise in temperature, sometimes to glowing, and the substance becomes a dark, hard, compact mass of iron oxides, the numerous cavities being lined with well-developed crystals (to 1 cm. diam.) of hæmatite and small octahedra of magnetite. Although the hæmatite crystals have all been formed under the same conditions (which are very similar to those in volcanic sublimations, as at Vesuvius), they vary considerably in habit, being tabular, rhombohedral, pyramidal, or prismatic. Analyses of the crystals by Löscher gave Fe_2O_3 87·38, FeO 12·45 = 99·83; and Fe_2O_3 86·45, FeO 11·78 = 98·23 per cent.; this indicates an intergrowth of magnetite with the hæmatite, as is also shown by the fact that the crystals are somewhat magnetic. The magnetite gave Fe_2O_3 71·18, FeO 28·72 = 99·90 per cent.
L. J. S.

Analyses of Magnesite, Dolomite, Mica, and Magnetite from Servia. By A. STANOJEVIĆ (*Ann. Géol. Pénins. Balkan.*, 1893, **4**, (2), 86—88).—Magnesite (I) and dolomite (II) from Avala gave

	SiO_2.	FeO.	CaO.	MgO.	CO_2.	Total.
I.	0·17	0·66	—	46·60	52·21	99·64
II.	4·37	3·97	24·12	22·25	45·90	100·61

White mica from near Vranja gave

SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	K_2O.	H_2O.	Total.	Sp. gr.
48·93	34·60	3·22	0·63	8·76	5·17	100·68	2·7

Iron ore of sp. gr. 5·01, from Suvo Rudisté (Kopaonik), gave

Insol.	CuO.	MgO.	Fe_2O_3.	FeO.	CO_2.	Total.
1·59	4·03	0·80	67·37	27·63	0·11	101·53

Analyses of other Servian ores are given. L. J. S.

Iglesiasite, Tarnowitzite, and Hemimorphite from Silesia. By HERMANN TRAUBE (*Zeit. deutsch. geol. Ges.*, 1894, **46**, 57—67).—*Iglesiasite* occurs on smithsonite at Radzionkau, in comb-like aggregations; analysis gave

PbO.	ZnO.	CO_2 [diff.].	$ZnCO_3$.	Sp. gr.
78·65	3·41	[17·94]	5·47	6·187

The crystals are flattened in the direction of the vertical (c) axis; $a : b : c = 0·59906 : 1 : 0·72465$. $2E_{Na} = 17° 7'$.

Tarnowitzite: Analyses of specimens from Tarnowitz gave

	CaO.	SrO.	PbO.	ZnO.	CO_2 [diff.].	$PbCO_3$.
Colourless........	54·09	0·28	2·24	—	[43·39]	2·61
Green	52·70	0·25	4·26	—	[42·71]	5·09
Reddish-brown ...	51·93	0 35	4·76	0·34	[42·62]	5·70
Yellowish........	53·43	trace	3·58	—	[42·99]	4·29

No connection can be traced between the composition and the colour. The crystals used in the last analysis have the habit of aragonite rather than of witherite.

Hemimorphite, from Scharley, was analysed on account of the unusual dark brownish-red colour; lead has not before been recorded in this mineral.

SiO_2.	ZnO.	PbO.	H_2O.	Total.	Sp. gr.
24·81	66·28	2·17	7·39	99·65	3·627

Crystallographic determinations are given of the above, and of good crystals of hemimorphite from Radzionkau, and of cerussite from Tarnowitz. L. J. S.

Spodiosite from Nordmark. By GUSTAF NORDENSKIÖLD (*Jahrb. Min.*, 1895, ii, Ref. 18; from *Geol. För. Förh.*, 1893, **15**, 460—466).—Spodiosite occurs as large, orthorhombic crystals, with chondrodite, amphibole, magnetite, and calcite in serpentine veins at Nordmark, Sweden. The freshest portion of the much decomposed mineral gave on analysis

P_2O_5.	SiO_2.	CaO.	$\underbrace{Al_2O_3.\ Fe_2O_3.}$	MgO.	F.	H_2O.	Total (less O for F).
29·62	8·74	45·84	2·83	8·56	2·94	3·76	100·60

As the SiO_2 and MgO belong to the serpentine, the formula becomes $m Ca_3P_2O_8 + n CaF_2$, where $m = 8$ and $n = 3$, this being analogous to apatite. L. J. S.

Celestite from Bourke, N.S.W. By GEORGE W. CARD (*Records Geol. Survey, N.S.W.*, 1893, **3**, 201—203).—A soft mass of sp. gr. 3·73 consisting of an aggregation of small crystals, gave, on analysis by J. C. H. Mingaye,

$SrSO_4$.	$CaSO_4$.	$BaSO_4$.	SiO_2.	Fe_2O_3 (Al_2O_3).	MgO.	NaCl.	H_2O.	Total.
93·57	0·99	trace	3·22	1·52	0·33	trace	0·70	100·33

L. J. S.

A supposed Sulphocarbonate of Lead. By P. T. HAMMOND (*Records Geol. Survey, N.S.W.*, 1895, **4**, 163—166).—White to colourless, brittle, orthorhombic crystals, with an imperfect cleavage, and an adamantine to resinous lustre, found on cerussite from Broken Hill, N.S.W., gave, on analysis by J. C. H. Mingaye,

PbO.	SO_3.	CO_2.	Total.
74·11	22·27	3·32	99·70
74·11	25·00	1·34	100·45

There is an absence of water; sp. gr. 6·22—6·33. The crystals differ in many points from leadhillite, and are probably anglesite, containing admixed cerussite, the latter possibly being due to the alteration of the former. L. J. S.

Zinciferous Melanterite, Seelandite and "Zinkmanganerz." By AUGUST BRUNLECHNER (*Jahrb. naturhist. Landes-Museums, Klagenfurt*, 1893, Heft **22**, 186—194).—Numerous minerals recently found in Carinthia are shortly described.

Melanterite (*zinciferous*) as small stalactites incrusting dolomitic limestone from Raibl, gave, on analysis,

FeO.	ZnO.	SO_3.	H_2O.	Total.
20·69	6·01	28·95	44·35	100·00

Seelandite: Colourless, white, or yellowish-white needles, occurring as an efflorescence on siderite from Lölling, gave

MgO.	Al_2O_3.	SO_3.	H_2O.	Total.
4·07	10·54	34·03	51·22	99·86

thus corresponding with the formula $MgAl_2(SO_4)_4 + 27H_2O$. [This is near to pickeringite; seelandite is a new name (see "*Carinthia*," ii, 1891, No. 2).]

"*Zinkmanganerz*": This "new species" occurs as a thin, dull, compact layer of reddish-brown or blackish-brown to steel-grey colour, in hemimorphite druses, or coating hydrozincite at Bleiberg. Streak, dark reddish-brown; fracture, even to flat, conchoidal. Given as a zinc manganite containing water.

Analyses of an impure limonite and a bituminous dolomitic limestone are also given. L. J. S.

Kentrolite from Jakobsberg. By GUSTAF NORDENSKIÖLD (*Jahrb. f. Min.*, 1895, ii, Ref., 241; from *Geol. För. Förh.*, 1894, **16**, 153—158).—Small, dark reddish-brown to black, orthorhombic crystals on inesite from Jakobsberg, Sweden, gave, on analysis,

SiO_2.	PbO.	Mn_2O_3.	Fe_2O_3.
16	50	19	1

L. J. S.

Action of Water on Apophyllite. By GIORGIO SPEZIA (*Jahrb. f. Min.*, 1895, ii, Ref., 242; from *Atti Accad. Sci.*, *Torino*, 1895, **30**, 455—465).—Water under a pressure of 1750 atmospheres at the ordinary temperature had no action on apophyllite from Poonah; under a pressure of 500 atmospheres at 93—107° there was no marked action; but water at 190—211°, and under the normal pressure for that temperature, strongly corroded the mineral in 13 days, producing beautiful etch-figures. Glass behaves in a similar manner.

L. J. S.

Lepidomelane, Actinolite, Andradite, Grossular, Hornblende, Clinochlore, Talc, Diallage, Damourite, Sericite, Cookeite, Cobaltiferous Löllingite, Bismuthite, Strontianite, and Native Iron from Canada. By G. CHRISTIAN HOFFMANN (*Report Geol. Survey, Canada*, 1895, **6**, R., 1—93).—*Lepidomelane* (I), brilliant, black plates in a granular mispickel at Marmora, Hastings Co., Ontario.

Actinolite (II), light greenish-grey, finely fibrous, from Westmeath, Renfrew Co., Ontario.

Andradite (III), massive, black, in thin splinters dark purple-red, from Cawood, Quebec; (IV), clove-brown, massive, from Fraser River, B.C.

Grossular (V), massive, honey-yellow, from Litchfield, Quebec.

Hornblende (VI), finely fibrous, radiated, blackish-green, from Fraser River, B.C. Analyses I to VI by F. G. Wait.

	I.	II.	III.	IV.	V.	VI.
SiO_2	32·79	56·70	36·09	34·52	36·80	38·79
Al_2O_3............	14·34	1·62	12·69	4·09	20·53	11·51
Fe_2O_3............	4·52	3·06	12·33	25·82	2·38	16·88
FeO............	26·32	7·19	3·30	2·66	0·56	15·96
MnO	0·29	0·30	0·48	0·94	0·50	0·62
NiO............	—	0·54	—	—	—	—
CaO............	1·45	10·62	34·46	31·49	37·41	11·57
MgO	4·68	17·20	0·94	0·59	1·51	2·86
K_2O............	7·24	0·24	—	—	—	1·36
Na_2O............	2·00	0·64	—	—	—	0·71
TiO_2	0·92	—	—	—	—	—
H_2O (at 100°)....	1·38	0·64	0·04	0·03	0·07	0·09
H_2O (above 100°).	3·68	2·05	—	—	—	0·83
	99·61	100·80	100·33	100·14	99·76	101·18
Sp. gr..........	3·19	2·941	3·690	3·706	3·623	3·404

Clinochlore (VII), white or faint bluish-white, scaly, from a scapolite-serpentine rock at Buckingham, Quebec, ; sp. gr. 2·631. (VIII), dark green, broadly foliated, from Bagot, Renfrew Co., Ontario. Both analyses by R. A. A. Johnston.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	Cr_2O_3.	MgO.	K_2O.	H_2O.	Total.
VII.	28·65	18·96	—	—	—	37·49	—	15·22	100·32
VIII.	27·23	19·44	2·17	4·91	0·99	32·67	0·08	12·04	99·53

Talc (IX), pale yellowish-green, foliated, from Grimsthorpe, Ontario; water at 100°, 0·32 per cent.; above 100°, 5·42. Analysis by Wait.

Diallage (X), thin-foliated, light greenish-grey, in serpentine, from Melbourne, Quebec.

Damourite (XI), scaly, yellowish-green, in a ferruginous dolomite, from Kicking Horse Valley, B.C. Over sulphuric acid, 0·68 per cent. of water was lost; at 100°, 0·03; on ignition, 5·54, = 6·25 per cent.

Sericite (XII), small, yellowish-white scales, forming 61·64 per cent. of a sericite-schist from Wait-a-bit Creek, Columbia River, B.C. Analysis was made on the portion of the rock insoluble in hydrochloric acid, the soluble portion consisting mainly of carbonates.

Cookeite (XIII), white or pale green, and foliated; occurs as thin bands in the sericite-schist above mentioned. Analyses X to XIII by Johnston.

	IX.	X.	XI.	XII.	XIII.
SiO_2	60·45	50·66	44·28	46·05	32·00
Al_2O_3	0·27	4·47	33·60	38·36	45·87
Fe_2O_3	0·78	0·70	0·62	0·97	—
FeO	2·04	2·75	—	—	—
Cr_2O_3	—	1·40	—	—	—
NiO	0·50	—	—	—	—
CaO	0·16	21·81	—	2·40	1·63
MgO	29·84	17·45	3·03	0·47	0·78
K_2O	—	—	9·87	6·19	0·06
Na_2O	—	—	0·40	2·98	0·65
Li_2O	—	—	—	0·34	2·10
Cs_2O	—	—	—	0·03	—
H_2O	5·74	0·69	6·25	2·48	17·29
F..........	—	—	0·59	—	0·02
Cl	—	—	0·51	—	—
	99·78	99·93	99·13	100·27	100·40
Less O for F	—	—	0·36	—	0·01
Sp. gr......	2·65	3·238	2·857	—	—

Cobaltiferous Löllingite, massive, steel-grey, with pyrrhotite, from Galway, Ontario. Analysis by Johnston gave, after deducting 1·69 per cent. of quartz,

As.	S.	Fe.	Co.	Ni.	Total.	Sp. gr.
70·85	0·81	24·67	2·88	0·79	100·00	7·028

Bismuthite, massive and foliated, lead-grey, from a granite vein at Jonquière, Quebec. Analysis by Johnston gave

Bi.	S.	Fe.	Pb.	Cu.	Total.	Sp. gr.
79·28	18·46	0·74	1·68	0·48	100·64	6·781

Strontianite, radially crystalline, pale yellowish-green to white, as veins in limestone at Nepean, Ontario. Analysis by Johnston gave

CO_2.	SrO.	CaO.	Insol.	Total.	Sp. gr.
30·54	65·43	3·38	0·17	99·52	3·704

Native iron occurs as small spherules, very similar to those previously described by the author (Abstr., 1895, ii, 20) in kaolin and limonite in a pegmatite vein at Cameron, Ontario. Analysis by Johnston gave

Fe.	Mn.	Ni.	S. P. Organic matter.	Insol.	Total.	Sp. gr.
90·45	0·75	trace	not det.	7·26	98·46	7·257

Copper and cobalt are absent. On dissolving in hydrochloric acid, there is a strong smell of phosphine. The insoluble concretionary nuclei contain 88·77 per cent. of silica, with some Al_2O_3, Fe_2O_3, and CaO.

The report also contains numerous analyses of ores, waters, &c.

L. J. S.

Xiphonite, a New Amphibole [Hornblende] from Etna. By Gaetano Platania (*Jahrb. f. Min.*, 1895, ii, Ref., 236—237; from *Atti rend. Accad. Sci., &c., di Acireale*, 1893, N. Ser., **5**, 55—62).—This occurs as small, light yellow to honey-yellow, transparent, monosymmetric crystals in the drusy cavities of a slaggy lava. It is supposed, together with the accompanying hæmatite, to have been formed by sublimation. On account of the feeble pleochroism, the light colour, and the special mode of occurrence, it is considered to be a distinct variety of hornblende. L. J. S.

Chemical Composition and Constitution of Vesuvians [Idocrase] and Wiluite. By Paul Jannasch and P. Weingarten (*Zeit. anorg. Chem.*, 1895, ii, 40—48; see also Abstr., 1895, ii, 319).—The paper contains the results of the complete analysis of (I) idocrase from Vesuvius, free from fluorine, of (II) idocrase from the same locality, containing fluorine, and (III) of idocrase from the Matterhorn.

	SiO_2.	TiO_2.	Fe_2O_3.	Al_2O_3.	FeO.	CaO.	MnO.	MgO.	K_2O.
I.	36·38	4·28	2·77	12·29	2·14	35·56	0·37	2·94	0·42
II.	37·15	0·50	3·28	15·73	1·94	35·49	0·52	2·64	0·38
III.	37·09	2·15	3·59	15·56	0·83	35·24	0·18	2·24	0·72

	Na_2O.	H_2O.	F.	Total.
I.	0·95	2·68	—	100·78
II.	0·67	1·97	1·68	101·95
III.	0·53	2·71	—	100·84

The results obtained agree with the former determinations, and are in accordance with the composition

$$Si_4O_{17}(AlFe''')_2(Ca,Mg,Mn,Fe'',K,Na)_5(H,F)_2.$$

A complete analysis of wiluite gave

SiO_2.	TiO_2.	B_2O_3.	Fe_2O_3.	Al_2O_3.	FeO.	CaO.	MnO.	MgO.
36·01	1·30	2·81	2·18	12·23	1·49	35·81	0·15	6·05

Na_2O.	Fl.	H_2O.	Total.
0·45	0·22	1·34	100·04

from which the formula,

$$(Si,Ti)_8O_{33}(Al,Fe''',B)_4(Ca,Mn,Mg,Fe'',Na)_{10}(H,F)_2,$$

is deduced. E. C. R.

Origin and Composition of Onyx Marbles. By GEORGE P. MERRILL (*Smithsonian Report, U.S. National Museum*, for 1893–4, 1895, 539—585).—Certain travertines and cave deposits of calcium carbonate, which are characterised by being banded and translucent, are the so-called onyx marbles or oriental alabasters; they are here shown (by their sp. gr.) to consist, in almost all cases, of calcite, and not of aragonite. The true onyx marbles are superficial deposits from hot springs, and, according to the view taken by the author, deposition has taken place slowly at the bottom of pools of water; cave marbles (that is, stalactites, &c.), on the other hand, are cold-water deposits, and are of greater purity. The former rarely contain less than 90 per cent. of calcium carbonate; iron oxide and carbonate being the next prominent constituents, these being the main cause of the wide range in colour. The pale and green colours are associated with ferrous carbonate, and the red-browns with ferric oxide, which latter has been produced by the oxidation of the carbonate along cracks and joints; for example, a green marble with 4·27 per cent. $FeCO_3$, contained in the brown-red (oxidised) portions 1·22 per cent. $FeCO_3$ and 3·53 per cent. Fe_2O_3. Some of the colour variations may be partly due to manganese; and in some amber-brown and yellow marbles (and one rose coloured) they are due to organic matter; they are rarely due to mechanical enclosures, such as clay.

Of the 16 analyses given, I is a white onyx marble, from Lower California; II, milk-white from Persia, also with 0·24 $Ca_3(PO_4)_2$; III, light green, from Mexico; IV, red-brown, from Arizona; V, dark amber, from California, containing organic matter, and 1·59 $SrCO_3$ and 0·11 $BaCO_3$.

	Sp. gr.	$CaCO_3$.	$MgCO_3$.	$FeCO_3$.	$MnCO_3$.	Fe_2O_3.	SiO_2.	$CaSO_4$.	H_2O.	Total.
I.	2·78	96·86	0·24	2·79	—	0·61	0·06	—	not det.	100·56
II.	2·75	90·93	0·75	1·37	4·34	—	—	2·30	—	99·93
III.	2·75	89·36	3·00	5·24	0·29	—	—	1·34	0·57	99·80
IV.	2·67	93·82	0·53	4·06	—	1·73	0·05	—	not det.	100·19
V.	2·70	95·48	2·20	—	—	—	—	—	0·37	99·75

These marbles are holocrystalline; sometimes granular, but more often fibrous or radially columnar in structure. The specific gravity varies from 2·64 to 2·79, and the hardness from 3 to 3·5; only in one case was the sp. gr. as high as 2·87 with H = 4, this being the only aragonite in the whole series examined. L. J. S.

Hislopite. By THOMAS H. HOLLAND (*Records Geol. Survey, India*, 1893, **26**, 166—171).—Calcite from the Deccan traps, containing patches of botryoidal "green earth," and small, bright crystals of heulandite, gave, on analysis,

Moisture.	Insoluble in acetic acid.	$Fe_2O_3 + Al_2O_3$.	CaO.	CO_2.	Total.	Sp. gr.
4·03	23·48	0·25	40·48	30·98	99·22	2·546

The iron, aluminium, and a little calcium are due to the slight solubility of the enclosures in the acid. A specimen from Nagpur, of sp. gr. 2·659, contained 4·615 per cent. of moisture and enclosures. The calcite varies from clear and colourless to green and opaque, owing to the unequal distribution of the enclosures; and the sp. gr. decreases as the amount of the enclosures increases. The "green earth" has a sp. gr. of 2·62; it is of indefinite composition, and possibly consists of glauconite and celadonite. L. J. S.

Alteration of Diabase and Granite. Formation of Clay. By PHILIP HOLLAND and EDMUND DICKSON (*Proc. Liverpool Geol. Soc.*, 1893, **7**, 108—117).—I, Analysis of the fresh rock of a diabase dyke in the granite, at St. Helier, Jersey; II, the brown, ochreous, clayey matter into which I is weathered. III, unaltered granite from the same locality; IV, the weathered, friable rock; V, clay derived from the same.

	I.	II.	III.	IV.	V.
SiO_2	43·56	44·93	70·23	71·22	48·44
TiO_2	1·03	1·34	14·73	14·92	27·24
Al_2O_3	14·58	16·27			
Fe_2O_3	3·84	13·37	2·37	2·36	5·04
FeO	7·00	—	0·98	0·07	—
MnO	0·39	0·28	0·18	0·20	0·38
CaO	10·78	1·84	0·94	0·44	0·38
MgO	9·95	6·40	0·50	0·68	2·93
K_2O	1·02	0·84	5·13	4·10	7·43
Na_2O	1·86	2·03	4·19	4·25	0·35
CO_2	1·93	—	—	—	—
H_2O	3·85	12·55	0·70	2·10	7·91
	99·79	99·85	99·95	100·34	100·10
Sp. Gr.	2·923	2·592	2·65	2·60	—

By the prolonged action of carbonic anhydride and water under pressure on such rocks, some calcium, magnesium, and iron went into solution. These alterations are discussed in connection with the formation of clay. L. J. S.

Amount of Silica and Quartz in Granites. By STANISLAUS ZALESKI (*Tsch. Min. Mitth.*, 1894, **14**, 343—359).—The percentages of silica and quartz (the latter being separated by means of a heavy solution) of various granites are given as

	SiO_2.	Quartz.	
Nigg (Kincardine)........	69·84	13·0	65·33
Baveno (Italy)...........	74·44	56·4	41·38
Dannemore (Sweden).....	61·06	15·2	54·08
Hangö (Finland)..........	71·42	29·5	59·46

The third column gives the calculated silica percentage of the rock after deducting the quartz, and as these figures differ considerably from the silica percentage of syenite (which has 58—60), it is considered that granite is not syenite *plus* quartz. L. J. S.

Fuller's Earth from Wingen, N.S.W. By GEORGE W. CARD (*Records Geol. Survey, N.S.W.*, 1894, **4**, 30—32).—A yellowish-green, unctuous clay from this locality gave the following analysis, by Mingaye. Under water, it softens and disintegrates; when heated, it becomes colourless, finally fusing to a green glass.

H_2O (moisture).	H_2O (combined).	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Total.
13·73	6·45	50·61	19·35	3·55	1·37	3·24	0·92	0·47	99·69

There is a trace of P_2O_5; FeO, MnO, and SO_3 are absent.

L. J. S.

Physiological Chemistry.

Metabolism Experiment on Sheep with a Pettenkofer Respiration Apparatus. By FRANZ LEHMANN (*Exper. Stat. Record*, 1895, **7**, 235—236; from *Landw. Jahrb.*, 1895, **24**, Suppl. 1, 117—119).—Proteïn, fat, starch, and cellulose were compared as producers of fat and lean meat respectively. Two sheep were fed with a ration rather more than sufficient for maintenance. After the production of lean and fat had been determined, the constituents to be tested were added in separate periods, between each of which the basal ration intervened. The amounts given in each period were as follows (in grams).

	Proteïn.	Fat.	Crude fibre.	N-free extract.
1. Basal......	96·9	15·2	84·7	287·7
2. Starch.....	98·2	15·1	89·8	369·0
3. Cellulose ..	100·2	16·7	156·8	320·3
4. Proteïn	178·5	16·0	88·5	312·7
5. Fat........	103·0	49·7	86·2	295·0

The basal ration resulted in a very slight production of lean meat and much fat. The addition of starch and cellulose gave rise (equally) to a considerable increase in lean, but cellulose was much inferior to starch in fat production. The addition of proteïn produced the greatest increase in lean, whilst fat produced fat alone, being without effect on the production of lean. N. H. J. M.

Normal Occurrence of Iodine in the Body. By EUGEN BAUMANN (*Zeit. physiol. Chem.*, 1895, **21**, 319—330).—In the course of investigations on the active physiological substance of the thyroid gland, a substance was obtained, to which the name *thyroiodin* is applied. The glands, when boiled for some days with 10 per cent. sulphuric acid, yield a liquid which deposits a flocculent precipitate; this, after extraction with alcohol, is regarded as the active substance. It may be a derivative of nucleic acid: it contains 0·54 per cent. of phosphorus, but it cannot be obtained from the thymus gland, nor from pure nucleic acid; the most remarkable point about it is that it contains iodine in organic union in considerable amount. W. D. H.

A Dermoid Cyst. By VICTOR LIEBLEIN (*Zeit. physiol. Chem.*, 1895, **21**, 285—287).—The contents of an ovarian cyst of dermoid nature contained 83—87 per cent. of water. The quantity of ethereal extract was large, and it contained cholesterol; isocholesterol and cetylic alcohol were not detected, although the latter is stated to have been found in a dermoid cyst by Sotnitschewsky, *ibid.*, 1880, **4**, 345.
W. D. H.

A rapid Method of Desiccating and Sterilising Serum. By CHARLES JAMES MARTIN (*J. Pathol. and Bacteriol.*, 1896, **3**, 507—509).—The simple apparatus used is figured. The method consists essentially in filtering the serum through a Pasteur-Chamberland filter into a bottle connected with a water pump; the whole is kept at 40°, and the serum, which comes through in bubbles, dries as quickly as it filters. W. D. H.

Excretion of Oxalic acid. By JAMES CRAUFURD DUNLOP (*J. Pathol. and Bacteriol.*, 1896, **3**, 389—429).—Oxalic acid is a constant constituent of the urine of men eating ordinary diet; in the urine, excess of calcium salts tends to precipitate the acid, but in normal urine this is prevented by acid sodium phosphate, and possibly by other substances. The precipitation is most liable to occur if the percentage of oxalic acid in the urine is high, and, in fact, actually occurs in about one in every three specimens; the precipitated calcium oxalate is in the form of octahedra. The daily excretion of oxalic acid averages 0·017 gram.

Alcohol is an efficient precipitant of the oxalate, and may be used in both qualitative and quantitative analysis. Oxalic acid is not a product of metabolism, but is absorbed directly from the food, and is excreted as such; increased acidity of the gastric contents aids absorption. Oxaluria is not a special morbid condition, but is essentially a hyperacid dyspepsia. W. D. H.

Experimental Anæmia in Dogs. By RALPH STOCKMAN (*J. Pathol. and Bacteriol.*, 1896, **3**, 385—388).—In one dog, anæmia was produced by bleeding; in another, by giving food containing insufficient iron. Both factors are probably concerned in actual chlorosis, as, in both dogs, examination of the blood from day to day, and of the organs after death, show many similarities to that disease. The animals, however, possess a power of regenerating the corpuscles, a power which in chlorosis is extremely limited by some superadded condition. W. D. H.

Acetonuria. By JOHN HILL ABRAM (*J. Pathol. and Bacteriol.*, 1896, **3**, 430—432).—The present experiments confirm Becker's (*Deut. med. Woch.*, 1895, No. 19) original statement that acetonuria follows anæsthesia in two-thirds of the cases, the anæsthetic used making no difference; if acetonuria is present before, anæsthesia increases it. The probable source of acetone is proteïd destruction. The practical outcome is that, except in cases of urgency, anæsthetics should not be administered to diabetic patients. W. D. H.

Hæmatoporphyrinuria. By ARCHIBALD E. GARROD and F. GOWLAND HOPKINS (*J. Pathol. and Bacteriol.*, 1896, **3**, 434—448).—Normal urine contains a little hæmatoporphyrin, but the amount is considerably increased by various conditions, especially by taking sulphonal. Three such cases are recorded in the present paper, which gives a clinical history of each case with chemical and spectroscopic examinations of the blood and urine. The causation of this condition is not yet fully explained, and the principal new point that comes out in the present research is that urinary hæmatoporphyrin does not imply excessive blood destruction; there is, at any rate, no corresponding increased excretion of iron. The best way to obtain the pigment from the urine is to add sodium hydroxide, and then extract the pigment from the washed precipitate of phosphates, or to saturate the urine with ammonium chloride, and extract the pigment from the urates with a mineral acid. W. D. H.

Poisoning of Cattle by Potassium Nitrate. By N. S. MAYO (*Exper. Stat. Record*, 1895, **7**, 250; from *Kansas Stat. Bull.*, No. 49, 3—11).—A number of cattle fed on dried cornstalks having died, the stalks were examined and were found to contain, both outside and inside, a quantity of potassium nitrate. The corn had grown on very rich soil formerly used as a hog lot. In direct experiments with potassium nitrate on animals, a heifer (about 500 lbs.) drenched with a solution of nitrate (300 grams) died within 24 hours; a cow (1,200 lbs.) was killed by 500 grams, and an adult rabbit by 5 grams of potassium nitrate. The symptoms are described in the original paper. N. H. J. M.

Poisonous Effects of Acetylene. By L. BROCINER (*Compt. rend.*, 1895, **121**, 773—774).—Experiments previously made by the author (*Annales d'Hygiene*, 1887, [3], **17**, 454) show that 100 vols. of blood dissolve about 80 vols. of acetylene; the solution shows no characteristic spectrum, and is reduced by ammonium hydrosulphide as readily as ordinary arterial blood. In a vacuum, part of the acetylene is evolved at the ordinary temperature and part at 60°. If the blood is allowed to putrefy, the volume of acetylene given off at the ordinary temperature remains practically the same, but the quantity liberated at 60° decreases as putrefaction advances. If any compound of acetylene and hæmoglobin is formed, it is very unstable, and is not analogous to carboxyhæmoglobin. The poisonous action of acetylene is very feeble, and animals can breathe large quantities of the gas for several hours without injurious effect, provided the proportion of oxygen is kept up to the normal amount, and the products of respiration are not allowed to accumulate (compare this vol., ii, 200).

C. H. B.

Chemistry of Vegetable Physiology and Agriculture.

Growth of Cholera Bacilli in Sunlight. By F. F. WESBROOK (*J. Pathol. and Bacteriol.*, 1896, **3**, 352—358).—Direct sunlight destroys cholera bacilli if they are in contact with air, but aids by its heating power the growth of those not in free contact with air.

W. D. H.

Origin of Atmospheric Oxygen. By THOMAS L. PHIPSON (*Compt. rend.*, 1895, **121**, 719—721).—Plants such as *Convolvulus arvensis*, grow readily in an atmosphere of moist nitrogen containing a certain quantity of carbonic anhydride, and eventually the atmosphere may contain more oxygen than is present in the air. The lower plants, such as *Protococcus*, *Conferva*, *Ulva*, &c., behave similarly, and, for a given weight, liberate much more oxygen in a given time than plants of higher organisation. These facts support the author's view that originally the earth's atmosphere consisted mainly of nitrogen, together with some carbonic anhydride, and that the presence of oxygen is due to the decomposition of the carbonic anhydride by plants. They also indicate that plants are essentially anaërobic, although the gradual increase in the proportion of oxygen in the air may have led to the gradual modification of the anaërobic cells and their conversion into aërobic cells like those of fungi.

C. H. B.

Metabolism and Respiration of Sprouting Potato Tubers. By E. ZIEGENBEIN (*Bied. Centr.*, 1895, **24**, 784; from *D. Landwirt*, 1895, No. 32).—Observations made with sprouts of *Lupinus luteus* showed that the albumin decomposes at about the same rate in absence, as in presence of oxygen. Free nitrogen was not evolved during 24 hours. The conditions of light only essentially influence the decomposition of proteïds, so far as light increases the production of carbonic anhydride in sprouting potato tubers, but hinders the growth of the shoots. The temperature optimum for the normal respiration of *Taraxacum officinalis* is 40° (the same as that found by Clausen for *Triticum*, *Lupinus*, and *Syringa* flowers), for sprouts of *Abies excelsa*, and seedlings of *Vicia faba* 35°, and for potato tubers 45°. Above these temperatures, the energy of respiration diminishes slowly until the maximum is reached (about 10° higher than the optimum), but very rapidly at still higher temperatures. N. H. J. M.

Assimilation of Lecithin by Plants. By JULIUS STOKLASA (*Sitzungsber. k. Akad. Wissens. Wien.*, 1895, **104**; Abth. I, 1—11).—Lecithin occurs in soil in quantities varying with the amount of organic matter. This and the importance of lecithin in the production of chlorophyll lend interest to the question of its assimilation by plants.

Water-culture experiments were made in which oat sprouts were grown in nutritive solutions (1) free from phosphorus, (2) containing calcium phosphate, and (3) containing lecithin. In the case of lecithin, the solution had to be frequently changed owing to the decomposition of the lecithin into glycerol phosphate, choline, and fatty acids. The plants grew best in presence of calcium phosphate. In the lecithin cultures, the nutrition was not sufficient, but the lecithin was no doubt assimilated. Without phosphorus, the plants produced no seed, and ceased growing after 96 days. The following table shows the average amounts of dry produce, the total phosphoric acid and the lecithin in the produce grown in solutions containing (1) calcium phosphate, (2) lecithin, and (3) no phosphorus.

	Dry produce.				P_2O_5.	Lecithin.
	Roots.	Stems, &c.	Grain.	Total.		
1 ..	3·95	18·47	7·45	29·87	0·110	0·120
2 ..	2·15	14·10	4·27	20·52	0·0605	0·0882
3 ..	0·68	1·41	—	2·09	0·0037	—

The results of the experiments show clearly the assimilation and utilisation of lecithin by the oats. Assimilation of phosphorus in an organic form by plants had not been proved before.

N. H. J. M.

Effects of Chlorides, Bromides, and Fluorides on Algæ. By M. WYPLEL [? WYPFEL] (*Bied. Centr.*, 1895, **24**, 785; from *Bot. Centr.*, 1895, **62**, 216; compare Abstr., 1895, ii, 175).—Different Algæ vary in their power of resisting the action of solutions of salts, the higher Algæ being more sensitive than the lower. *Spirogyra* is the most sensitive, then *Œdogonium Vaucheria, Stichococcus, Oscillaria, Pleurococcus*, and *Protococcus* in the order given. As regards chlorides, the ammonium salt is the most injurious, then manganese, aluminium, and barium chlorides. Even *Protococcus* dies in 2—4 per cent. solutions of these salts. Magnesium chloride is the least injurious; the sodium and strontium salts are less active than potassium chloride. Of bromides, the ammonium salt is again the most injurious, then potassium and sodium salts. Sodium, potassium, and ammonium fluorides are injurious even in 1/8th per cent. solutions.

Sodium and calcium nitrates are more favourable to Algæ than potassium nitrate. The effect of the chlorides, &c., is to retard growth and hinder division of cells. The amount of starch is diminished, the cell membrane thickened, and the colour of the chlorophyll changed and finally destroyed. Weak solutions are injurious after prolonged contact. N. H. J. M.

Effect of Copper Salts on the Growth of the Vine and on Soil. By BERLESE and LIVIO SOSTEGNI (*Bied. Centr.*, 1895, **24**, 768—769; from *Bot. Centr.*, 1895, **63**, 270).—When copper bicarbonate is added to a nutritive solution in which vines are growing, the copper is taken up in traces by the roots. Vine leaves are more sensitive to soluble copper salts than the *Peronospora* mycelium, and the leaf is only protected from *Peronospora* as long as soluble copper compounds are present on the surface. The mycelium will develop on portions of leaves not reached by the copper solutions. When the roots of a vine were allowed to grow in 1 per cent. aqueous copper sulphate, copper could only be detected in the roots. In the case of branches immersed in copper sulphate solution, only the walls of the fibrovascular bundles were attacked at first, after which the solution penetrated further mechanically. Contrary to Millardet, it was found that only the collenchyma, and never the cuticula, took up copper.

In the absorption of copper sulphate by soil, lime takes the predominant part, alkalis, magnesia, iron, and alumina being dissolved. Humic acid and silicates do not combine with copper. The copper remains in the soil as oxyhydrate of the basic sulphate, or as a double salt of copper and calcium. The basic sulphate being readily decomposed by carbonic anhydride, dissolves, and is absorbed by plants. N. H. J. M.

Injurious Action of Cobalt and of Barium on Plants. By EMIL HASELHOFF (*Landw. Jahrb.*, 1895, **24**, 959—961; 962—967).—By means of water-culture experiments, it was shown that, like nickel (Abstr., 1894, ii, 208), cobalt is injurious to vegetation; 1 to 2 parts per million being sufficient to destroy the plants.

As regards barium, experiments with maize and with beans showed that very small amounts injure vegetation. The ashes of plants so treated contained small amounts of baryta. It is possible that increased application of lime would, to some extent, hinder the taking up of baryta by the plant. N. H. J. M.

Pectase. By GABRIEL BERTRAND and ALFRED MALLÈVRE (*Compt. rend.*, 1895, **121**, 726—728).—Pectase is of very common occurrence in plants (compare Abstr., 1895, i, 312), and was found by the authors in 40 species of plants containing chlorophyll, five of which belonged to the cryptogams. It is found in the roots, stems, leaves, flowers, and fruit. The time required for the plant juice to coagulate a 2 per cent. solution of pectin varies from less than a minute, in the case of potatoes, clover, lucern, and others, to two hours in the case of carrots, and 48 hours in the case of ripe tomatoes. The activity of the ferment varies not only with different plants, but also with different organs of the same plant, and as a rule is most abundant in the leaves, and especially the leaves of rapidly growing plants.

It can be prepared from the leaves of lucern or clover in vigorous growth; these are bruised and pressed, and the juice is saturated with chloroform and allowed to remain for 24 hours in a well-closed flask in the dark. It is then filtered, the limpid filtrate mixed with twice its volume of alcohol of 90°, and the white precipitate thus formed is suspended in a small quantity of water. After 12 hours, it is filtered, and the filtrate allowed to run into a large excess of alcohol; the precipitated pectase, when dried in a vacuum, forms a white, non-hygroscopic solid, very soluble in water. C. H. B.

Laccase in Fungi. By EMILE E. BOURQUELOT and GABRIEL BERTRAND (*Compt. rend.*, 1895, **121**, 783—786).—Examination of 200 different species of fungi belonging to different genera shows that the great majority contain laccase, and in certain cases the presence of laccase coincides with the existence of a distinct odour, and in others with the existence of constituents that become coloured when exposed to air. Whilst in some genera or sub-genera such as *Russula*, *Lactarius*, and *Psalliota*, almost all the species contain laccase; in others, such as *Marasmius*, *Hygrophorus*, *Cortinarius*, and *Amanita*, few or none contain the ferment. Further, the proportion of laccase varies in different parts of the same plant, and may be absent in the young plant, but present at a later stage of development (compare Abstr., 1895, i, 386). C. H. B.

Amount of Substances soluble in Water in Plants. By E. GAIN (*Exper. Stat. Record*, 1895, **7**, 187—188; from *Bull. Soc. Bot., France*, 1895, **41**, 53—67).—The amounts of soluble matter in plants grown in dry and in wet soil were determined by macerating the powdered substances with hot water and determining the dry matter in the extracts. The results show that plants grown in wet soils contain more soluble matter than when grown in dry soils, and that the parts of the plant above-ground contain more soluble matter than the roots. In comparing analyses of most plants, it is very important to consider the different conditions under which they were grown.
N. H. J. M.

Sulla (Heydoarum coronarium). By L. GRANDEAU (*Exper. Stat. Record*, 1895, **7**, 206—207; from *J. Agr. Prat.*, 1895, **59**, 812—814 and 850—854).—Perennial, white sulla is considered suitable for meadows on thin, poor, dry soils, and is said to thrive, even on pure schists. There are also a native Algerian biennial variety, and a red variety. The stems and leaves of red sulla were analysed with the following results (per cent. in fresh substance).

Water.	Proteïd.	Fibre.	N-free extract.	Fat.	Ash.	P_2O_5.	K_2O.
85·00	2·38	4·63	5·75	0·27	1·97	0·117	0·116

The fresh roots had the following percentage composition.

Water.	Organic matter.	N.	Ash.	K_2O.	CaO.	MgO.	P_2O_5.
78·50	19·49	0·22	2·01	0·10	0·32	0·11	0·06

The plant withdraws less potash from the soil (72 lbs. per acre) than most other leguminous plants. Owing to the immense quantity of nitrogen in the crop (224 lbs. per acre), presumably obtained largely from the air, sulla seems well suited as a crop for green manuring on land not irrigated in semi-arid regions.

The nutritive value is about the same as that of red clover.

N. H. J. M.

Importance of Potash as Plant Food. By C. von Feilitzen (*Bied. Centr.*, 1895, **24**, 732—733; from *Svensk. Mosskult.-förening. tidskr.*, 1894, 283—287; 1895, 211—214).—In a number of zinc cylinders filled with peaty soil, well limed in 1888 and 1892, and yearly manured with (2) basic slag alone, (3) kainite and (4) felspar, respectively, oats, clover (two years), rye, and peas were successively grown; there was also a short experiment (1) without manure. Oats and rye had, in addition, a dressing of sodium nitrate. The following amounts of produce were obtained (in grams).

	Oats.		Clover (green).		Rye.		Peas.	
	Straw.	Grain.	1890.	1891.	Straw.	Grain.	Straw.	Grain.
1....	25·3	7·4	0	3·0	16·0	2·0	23·5	7·0
2....	115·6	56·3	318	71·0	52·0	19·0	102·5	63·7
3....	123·8	62·2	589	70·3	98·6	40·0	120·0	100·0
4....	112·6	54·6	349	97·4	54·6	20·3	92·8	58·2

The importance of potash for peaty soils was also shown by the results of field experiments in various parts of Sweden. Both insufficient and excessive potash manuring should be avoided, as potash is not so readily absorbed by the soil as phosphoric acid. Thus, the drainage from the peaty soils of Jönköping generally contain 0·3—0·5 gram (on one occasion 1·2 gram) of potash per hectolitre; 2—26 grams of lime; only traces of phosphoric acid. N. H. J. M.

Application of Phosphates and Superphosphates to Acid Soils. By G. Pageot (*Bied. Centr.*, 1895, **24**, 743—744; and by L. Grandeau (*ibid.*, 744); from *Jour. Agric. Prat.*, 1895, **2**, 334—337 and 337—338 respectively).—Pageot found that the soil contained P_2O_5 0·035, K_2O 0·042, Na_2O 0·060, CaO 0·879, MgO 0·110, SO_3 0·068, and N 0·193 per cent. Whilst basic slag and crude phosphate had no appreciable effect, superphosphate converted the worthless, sterile soil in three years into a fertile arable soil which yielded 30 to 35 hectolitres of wheat per hectare.

Grandeau suggests that the favourable effect of superphosphate compared with the other phosphates may be due to the sulphuric acid it contains. Sulphur in an assimilable form is essential, and nothing is known as to the availability of the sulphate in the soil in question.

N. H. J. M.

Investigations [on Manures] at Halle. By Max Märcker (*Bied. Centr.*, 1895, **24**, 734—743; from *Ber. Versuchs-Stat. Halle a. S.*, 1895, 49 pp.).—*Application of Crude Potassium Salts to Beetroot.*—Whilst in extremely wet or dry seasons the application of potash has no certain quantitative effect, in moderately dry years the effect will always be considerable. It is only in very special cases that potash can act injuriously on the production of sugar.

Experiments on Manuring Beetroot with Potassium and Sodium Nitrates.—Experiments were made in order to decide whether it is the nitrogen of sodium nitrate, or the soda which causes diminished sugar production in beetroot. The results showed that with small applications of sodium and potassium nitrates respectively, the roots manured with potassium nitrate contained rather less sugar than those manured with sodium nitrate, and that with large applications there was slight diminution in the amount of sugar in both potash and soda plants; so that sugar production may be diminished by potassium as well as by sodium nitrate.

Experiments with Phosphates.—Potassium metaphosphate, a product of the Stassfurt industry, containing 53·6 per cent. of phosphoric acid, gave good results with barley; it is probably rapidly changed into orthophosphoric acid, either in the soil or in the plant. The phosphates of the sludge of sugar works gave very poor results with a first crop, owing to the amount of free lime present; with a second crop, however, very good results were obtained, and it is thought that a heavy dressing would render phosphate manuring unnecessary for two years. Bone meal, as compared with bone superphosphate, has comparatively little effect in the second year. As a nitrogenous manure bone meal may give, according to the conditions, very good results. As regards basic slag, the best results are obtained with products rich in citrate-soluble phosphates, not only with the first but with subsequent crops.

Stable Manure and its Constituents.—The effect of sodium nitrate was compared with (1) urine, (2) fæces, (3) mixture of fæces and urine, and (4) stable manure. The nitrogen of urine gave very satisfactory results, an average of 89·2 per cent. of the effect of the nitrogen as sodium nitrate. The nitrogen of fæces gave only a very slight increase of produce, about 11 per cent. of the effect of an equal amount of nitric nitrogen. The effect of the mixture of fæces and urine was about the same as when used singly, whilst stable manure showed an average effect of 34·25 per cent. of an equal amount of nitric nitrogen.

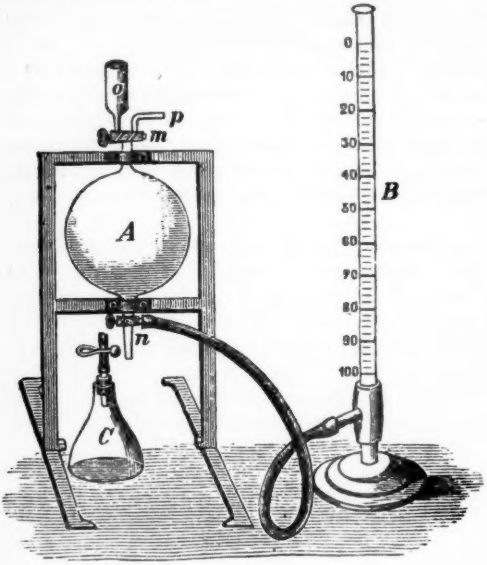
As regards losses of nitrogen in animal excrement, the results of experiments showed that whilst fæces and urine lost over half the total nitrogen (in five months), the addition of peat litter alone reduced the loss to 20·11 per cent. With a small quantity of phosphoric acid (as well as peat litter), the loss was 21·78 per cent.; with four times the amount of phosphoric acid, 7·82 per cent.; with small and larger amounts of sulphuric acid (2 and 4 per cent. of the dry matter of the peat), the losses were 5·68 and 5·64 per cent.; whilst with lime (10 per cent. added to the peat) 16·5 per cent. of the total nitrogen was lost. The best of the mixtures is therefore peat and sulphuric acid (2 per cent.). Nitrification was most active under the influence of lime, 29·82 of the total nitrogen being nitrified in the five months of the experiment (28·76 in the first two months). The next largest amount of nitric nitrogen was produced under the influence of the greater amount of phosphoric acid, namely, in five months, 22·11, and in two months 4·08 per cent. of the total. With sulphuric acid (4 per cent.), there was, after five months, only 1·52 per cent. of the total nitrogen in the form of nitric acid; whilst with 2 per cent., 16·41 per cent. of the nitrogen was nitrified. In the original substance alone, 3·37 per cent. of the nitrogen was nitrified; with the addition of peat, 19·49 per cent. was nitrified. In the original paper, the percentage amounts of albuminoïd, ammonia, nitric and amide nitrogen in the original mixtures, and, after two and five months respectively, are given in a table.

Effect of Kainite and Carnallite on the yield and composition of Grass.—By potash manuring, the vegetation of meadows becomes less nitrogenous, although the total nitrogen is greater. With carnallite, at least as much nitrogen was taken up as when kainite was employed. Under the influence of potash, the first crop is rendered distinctly poorer in phosphates, whilst the second crop is much richer than without potash manure. The first cutting of grass manured with potash is much richer, and the second crop poorer, in potash than when no potash is applied. N. H. J. M.

Analytical Chemistry.

Apparatus for Gas Analysis. By Otto Bleier (*Ber.*, 1896, **29**, 260—265; compare this vol., i, 70).—The author describes a form of the Orsat-Muenke apparatus modified in accordance with the principles laid down in his previous paper. The measuring tube is connected below with a three-way cock, so that the water can be slowly run out, and be replaced by the gas to be analysed. A two-way cock is attached to the top of the measuring tube, and serves to connect the tube with the pipettes, or with the vessel from which the sample of gas is to be taken. The first two absorption pipettes are also fitted with three-way cocks. The advantages of the apparatus are that time is saved by the automatic measurement of the gas, and that the solubility of the gas in water introduces no error.

An apparatus is also described which can be used for gas titration, or for complete gas analysis. The glass bulb A (see Fig., next page), of 500—600 c.c. capacity, has attached to its upper end a two-way cock, and to its lower a three-way cock, which is attached by india-rubber tubing to the measuring tube B. An exhausted flask, C, can also be attached to the three-way cock by means of the tube *n*, which also serves to empty the bulb of any liquid. For a gas titration, the bulb is first dried, and then the gas is introduced, either through *p* or *n*, according as it is heavier or lighter than air, and is allowed to pass through for a short time till all the air is displaced; it is then measured at atmospheric temperature and pressure. If it is not necessary to measure the absorbent liquid (for example, water for ammonia or hydrogen chloride, sodium hydrogen carbonate for sulphurous anhydride), it is run in from the cup O, and finally run out through *n* into the exhausted flask, the bulb is washed out with water, and the washings are also run into the flask. The contents of C are then titrated in the usual way. If it is necessary to measure the amount of absorbing liquid used, this is accomplished in B, care being taken to remove all the air in the rubber tube by allowing a small quantity of the liquid to flow out through *n*. If the apparatus is to be used for absorption analysis, the gas is measured by the replacement of water in the bulb, the absorbing liquid is placed in B, and the absorption is then measured by diminution of liquid in B. After one absorption, the liquid can be removed, the measuring tube washed out, and then filled with the second absorbent. J. J. S.



Apparatus for Quantitative Electrolysis. By MAX GRÖGER (*Zeit. angw. Chem.*, 1895, 625—626).—The apparatus consists of a battery glass 80 mm. wide, 30 mm. broad, and 120 mm. high, through one short side of which passes a horizontal platinum wire, 1 mm. thick, and 70 mm. long, from which is suspended the cathode. This consists of a carefully weighed square of platinum foil (12 grams in weight) reaching nearly to the bottom of the glass. On the opposite side to the long wire is fixed a short, bent wire, from which is suspended the anode, which consists of a 1 mm. thick, looped platinum wire, weighing about 16 grams: this is first bent rectangularly, the ends being finally twice bent upwards and downwards so as to form a series of loops on each side of the cathode. The galvanic current is admitted from the outside through connecting pieces attached to these wires. During the electrolysis, the glass is covered, to prevent loss by spirting, the cover being occasionally rinsed. The principal advantage of the apparatus is the cheapness of the electrodes. L. DE K.

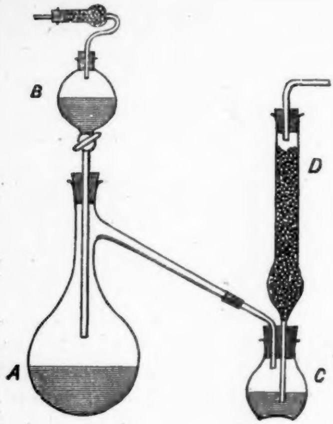
Estimation of Water in Silicates. By PAUL JANNASCH and P. WEINGARTEN (*Zeit. anorg. Chem.*, 1895, **11**, 37—39; compare Abstr., 1895, ii, 325).—The authors have modified their process of estimating the water in silicates by heating them, mixed with dry borax, in a current of dry air, so that the sample employed may be used for the estimation of other constituents. The method is identical with that previously described, except that the mixture of silicate and borax is heated in a platinum boat; it is essential that the mixing be very thorough. E. C. R.

Citrate Method of determining Phosphoric acid. By F. Bergami (*Exper. Stat. Record*, 1895, **7**, 180—181; from *Journ. Franklin Inst.*, 1895, **140**, 139—152).—The method, which is especially for insoluble phosphates, is as follows. The substance (2 grams) is boiled with a mixture of strong nitric (40 c.c.) and hydrochloric acids (10 c.c.), diluted to 250 c.c., and aliquot parts of the solution, corresponding with 0·2 and 0·4 gram of substance, are mixed with 20, 50, 75, and 100 c.c. respectively of Märcker's citrate solution, prepared by dissolving citric acid (250 grams) in water, adding 24 per cent. ammonia (500 c.c.), and diluting with water to 1500 c.c. 25 c.c. of official magnesia mixture is then added, the whole well stirred for half an hour, and the precipitate treated as usual.

The results depend largely on the amount of citrate solution employed. With high grade phosphates (20 to 30 per cent.), the best results are obtained by using 50 to 75 c.c. of citrate solution for 0·2 gram of substance, or 75 c.c. to 100 c.c. for 0·4 gram. Slightly lower results were obtained than with the molybdate method, probably owing to an excess of citrate. N. H. J. M.

Rapid Estimation of Insoluble Phosphate. By Vincent Edwards (*Chem. News*, 1896, **73**, 25).—Although not advocating the substitution of a volumetric for the gravimetric method of estimating insoluble phosphate, yet the following method is submitted as satisfactory. The residue, from the exhaustion of 0·5 gram of the substance with cold and hot water, is boiled for a short time in water containing a very small quantity of hydrochloric acid, filtered, made up to 300 c.c., rendered alkaline with ammonia, and then faintly acidified with acetic acid. The solution is then placed on a sand bath and titrated hot with standard uranium acetate of the strength 1 c.c. = 0·01 gram $Ca_3P_2O_8$. D. A. L.

Testing for Arsenic in Alloys of Tin and Lead. By Leonard de Koningh (*Ned. Tydschr. Pharm.*, 1895, **7**, 330—331).—The alloy is distilled with hydrochloric acid and ferric chloride in a small retort, connected with a large Peligot tube containing a little water. It is advisable to apply but a very gentle heat at first, so that the solution may take place at the expense of the chlorine of the ferric chloride; the evolution of hydrogen is then hardly noticeable, and the formation of arsenic hydride is reduced to a minimum. Finally, the liquid is distilled nearly to dryness; the arsenic in the distillate may be at once precipitated by hydrogen sulphide. L. de K.



Apparatus for the Estimation of Sulphur in Iron. By E. J. Read (*Chem. News*, 1895, **72**, 299).—The end of the tube D is adjusted in the flask C, so that some of the absorbing liquid is forced up among the beads by the passage of the gas, evolved from the sample in the flask A, by the action of the acid from B. The apparatus is preferably used under reduced pressure.

D. A. L.

Estimation of Sulphur and Carbon in Zinc. By Robert Funk (*Zeit. anorg. Chem.*, 1895, ii, 49—58; compare this vol., ii, 247).—The sulphur is estimated as follows. About 20 grams of the zinc is dissolved in pure hydrochloric acid, and the gas evolved passed through a Pettenkofer's tube (50 cm. long), containing a mixture of equal volumes of a solution of zinc sulphate (2 per cent.) and ammonia (0·5 per cent.). The contents of the tube are transferred to a glass cylinder, acidified with hydrochloric acid, and mixed with 1 c.c. of a solution of paramidodimethylaniline in hydrochloric acid (1 : 500), and a few drops of a solution of ferric chloride (10 per cent.). If sulphur is present, a coloration of methylene-blue is produced, and this is compared with the colour produced by a known quantity of hydrogen sulphide. In order to remove any sulphurous acid or hydrogen sulphide which may be present, the hydrochloric acid employed must first be boiled with a small quantity of potassium chlorate, and the excess of chlorine removed with pure zinc or alcohol. Various samples of purified zinc, when examined by this method, were found to contain from 0 to 2·5 parts of sulphur in 10,000,000 parts of zinc.

The carbon is determined by burning the zinc with copper oxide. A combustion tube, closed at one end, is charged with a column, 8 cm. long, of freshly fused potassium chlorate, then with a column of granular copper oxide, followed by the zinc in a porcelain boat, and another column of copper oxide. The tube is exhausted by means of a mercury pump, and after the front column of copper oxide has been heated to redness, the zinc is volatilised. When the zinc is entirely volatilised, the potassium chlorate is cautiously heated; the evolved oxygen is at first entirely absorbed by the metals; when this absorption ceases, which is indicated by a mercury manometer, and the pressure in the tube reaches that of the atmosphere, the gas is allowed to pass through a Pettenkofer's tube, containing a solution of barium hydroxide or basic lead acetate. The sample of zinc to be tested is first washed with hydrochloric acid, and then dried in a current of hydrogen.

By the above methods 1 part of sulphur in 10,000,000 parts of zinc and 1 part of carbon in 100,000 parts can be detected. The purified zinc of commerce contains distinct traces of sulphur and minute traces of carbon. These impurities are not soluble in the metallic zinc, and can be completely separated by filtration through asbestos.

E. C. R.

Estimation of Sulphurous Anhydride in Carbolic Powders. By LEONARD DE KONINGH (*Ned. Tydschr. Pharm.*, 1895, **7**, 329—330).—Ten grams of the sample is distilled with hydrochloric acid, and the distillate is condensed in a large Peligot tube containing a little water and a sufficiency of bromine. The distillation is continued until the bromine has been nearly decolorised by the action of the phenol or cresol vapours. After filtering, the liquid is precipitated by barium chloride, and the precipitate calculated into sulphurous acid.

When testing carbolic powders, it must be remembered that the greater part of the sulphurous acid may have been lost either through evaporation or oxidation. L. DE K.

Separation of Quartz from other varieties of Silica. By GEORG LUNGE (*Zeit. angw. Chem.*, 1895, 593; 689—690).—A reply to Michaelis stating that aqueous soda decidedly attacks quartz, and that in any case it is much the same thing from an analyst's point of view whether the finely divided quartz is lost by actual solution or by mechanically passing through the filter.

The author still prefers using sodium carbonate. L. DE K.

Detection and Estimation of Barium Sulphate. By LEONARD DE KONINGH (*Ned. Tydschr. Pharm.*, *&c.*, 1895, **7**, 257).—To test insoluble siliceous matters for admixed barium sulphate, the author recommends heating with strong sulphuric acid, which soon dissolves the barium compound, and leaves the silicate wholly, or partially, insoluble.

After decanting, or filtering through a suitable medium, the barium sulphate may be completely recovered by diluting with water. If the mixture should contain lead, recognisable by the ammonium sulphide test, this must first be removed. L. DE K.

Volumetric Method for Lead Analysis. By ALFRED C. BEEBE (*Chem. News*, 1896, **73**, 18).—The substance is dissolved in nitric acid, with a little hydrochloric acid, if required, evaporated with sulphuric acid until white fumes of sulphuric anhydride are evolved, diluted, cooled, an equal volume of alcohol added, and, after a short time, filtered, and washed well with hot water. The precipitate is digested, with frequent and vigorous stirring, for 15 minutes, in a cold saturated solution of ammonium carbonate, filtered, the lead carbonate washed thoroughly with hot water, dissolved in hot dilute acetic acid, cooled and titrated with a 1 per cent. solution of potassium ferrocyanide, using uranium acetate acidified with acetic acid as the indicator. In this method, barium and calcium are harmless; arsenic, iron, copper, and zinc should be eliminated in the thorough washing of the lead sulphate; whilst antimony could be removed by the use of tartaric acid in the decomposition of the substance.

D. A. L.

Estimation of Manganese and Tin by Electrolysis. By Carl Engels (*Ber.*, 1895, **28**, 3182—3189).—Manganese peroxide is deposited in a perfectly coherent form when 10 grams of ammonium acetate and 1·5—2 grams of chrome alum are added to a solution of manganese sulphate containing 0·2—0·25 gram of manganese in 150 c.c. water. The electrolysis must be carried out in a platinum vessel with a matt surface, a current density of 0·6—1 ampère, and an electromotive force of 3—4 volts being used. The deposit is washed, ignited, again washed to remove small traces of chromium compounds, and finally heated and weighed. Alcohol and ammonium acetate also produce good and coherent deposits of manganese peroxide. The addition of a hydroxylamine salt to an acid solution of a manganese salt prevents the deposition of manganese peroxide, and thus enables several separations to be carried out.

Tin can also be readily obtained in a coherent film by electrolysis, adding to the solution hydroxylamine sulphate, together with a little ammonium acetate and tartaric acid, a current density of 0·5—1 ampère and an electromotive force of 4—6 volts being used.

The methods proposed for both manganese and tin appear to give excellent quantitative results. A. H.

Analysis of Chrome-iron Ore, Ferrochromium, and Chrome-steel. By Samuel Rideal and Sigmund Rosenblum (*Chem. News*, 1896, **73**, 1—2).—The authors review the past work on, and give a bibliography of, this subject. They point out that finely powdered chrome-iron ore and ferrochromium may be decomposed by fusing with sodium peroxide, in the first case for five, in the second for ten, minutes, and in both cases allowing to cool slightly, adding more peroxide, and heating again. Before the subsequent titration, the solution should firstly be boiled for 10 minutes, then acidified, and finally filtered, if necessary. D. A. L.

Technical Analysis of Cyanide Working Solutions. By William Bettel (*Chem. News*, 1895, **72**, 298—299; compare this vol., ii, 224).—Simple or readily decomposable complex cyanides are not affected by dilute permanganate in an acid solution and in the absence of organic matter, but *ferrocyanides* and *thiocyanates* are rapidly oxidised. Therefore, to estimate the latter, the quantity of both is first ascertained by titrating 10 or 20 c.c. of N/100 permanganate, strongly acidified with sulphuric acid, with the cyanide solution; then the proportion of thiocyanate is determined by removing the ferrocyanide from 50 c.c. of the cyanide solution by means of acidified ferric chloride or sulphate, and titrating with N/100 permanganate.

Oxidisable organic matter in solution is estimated by digesting 50 c.c. of the solution for an hour at 60—70° with a large excess of strongly acidified N/100 permanganate, then cooling, and titrating back with a standard thiocyanate solution, of a strength such that 1 c.c. = 1 c.c. N/100 permanganate. The amount of organic matter is approximately nine times the oxygen consumed in excess of that required by the ferrocyanides and thiocyanates present. The organic matter can be removed by shaking with quicklime and filtering.

Alkalinity.—With N/10 acid and phenolphthaleïn as indicator, all the potassium cyanide, 7·9 per cent. of the potassium zinc cyanide, and the potassium in potassium zinc oxide are estimated; with methyl orange as indicator, all the zinc in potassium zinc cyanide, the zinc and potassium in potassium zinc oxide, and the hydrogen carbonates are estimated. When a caustic alkali or a carbonate is added to a working cyanide solution containing zinc, the following changes ensue: $K_2ZnCy_4 + 4KHO = ZnK_2O_2 + 4KCy$ and $K_2ZnCy_4 + 4Na_2CO_3 + 2H_2O = 2KCy + 2NaCy + ZnNa_2O_2 + 4NaHCO_3$. The hydrogen carbonates have no action on potassium or sodium zinc cyanide, which is only partially decomposed by calcium or magnesium hydroxides, so some alkalinity towards phenolphthaleïn may be due to the former compounds in the presence of potassium zinc cyanide. If lime or magnesia is added to a solution containing sodium hydrogen carbonate and potassium zinc cyanide, the zinc remains in solution as sodium zinc oxide, and the percentage of cyanide is correspondingly increased.

Ferricyanide is estimated by reduction with sodium amalgam and titrating the resulting ferrocyanide.

Sulphide is estimated by agitating with precipitated lead carbonate and titrating with permanganate; loss above that due to ferrocyanides, thiocyanates, &c., is due to the sulphides eliminated.

Ammonia is estimated by precipitating all the cyanide compounds in 10 c.c. with silver nitrate, adding hydrochloric acid, making up to 100, shaking, filtering, distilling 10 c.c. of the filtrate with 150 c.c. of water, and Nesslerising the distillate.

Methods for dealing with urea, oxamide, and formates are under investigation. A few specimen analyses are appended to the paper.

D. A. L.

Estimation of Fusel Oil in Rectified Spirits by Röse's Process. By M. Glasenapp (*Zeit. angw. Chem.*, 1895, 657—663).—The author has made a thorough investigation of Röse's chloroform process, and finds that, although it works very well for the cruder samples of spirits, it is only by taking extraordinary precautions that trustworthy results can be obtained with the purer kinds. The author's shaking apparatus is made of such a weight and shape that, when filled and plunged into water, it sinks down in a vertical position, so that, after some time, the contents will acquire the exact temperature desired. Even if the measuring tube is most carefully graduated, no two apparatus will agree, unless they are exactly of the same capacity. The reason of this is that, during the shaking, the air becomes saturated with chloroform vapour, and the amount thus lost will be, of course, proportionate to the bulk of the air. Every apparatus must, therefore, be carefully calibrated. Another important item is the time allowed for the chloroform layer to separate; the author advises waiting for at least one hour. The greatest difficulty of all is to obtain a standard alcohol really free from fusel oil, and it is doubtful whether such alcohol has ever, as yet, been obtained. The only plan is to keep on rectifying until the fractions give a constant result when tested in the apparatus. It is also of the utmost importance that the spirit to be tested should be diluted to a sp. gr. of 0·96564 at

15·5°, and for this purpose it is not sufficient to use a Westphal balance, but a very delicate specific gravity bottle should be used. Particular stress is laid on the necessity of thoroughly cleaning the instrument before making a new experiment. A mixture of sulphuric and Nordhausen acid is recommended for this purpose. L. DE K.

Estimation of Sugar. By G. OPPERMANN (*Exper. Stat. Record*, 1895, **7**, 184; from *Apoth. Zeit.*, 1895, **10**, 216).—The method in which the cuprous oxide is reduced with hydrogen and weighed as copper is modified as follows. The cuprous oxide, filtered in a tube packed with asbestos, is well washed, and dissolved in moderately strong nitric acid, avoiding a great excess. The copper is precipitated electrolytically, washed, dried, and weighed.

N. H. J. M.

Influence of the two Lead Acetates on the Estimation of Invert Sugar by the Fehling-Soxhlet Method. By ARTHUR BORNTRÄGER (*Zeit. angw. Chem.*, 1895, 594—596).—The author has tabulated several experiments with invert sugar solutions containing an excess either of lead acetate or of basic acetate.

It appears that, when titrating in the well-known way with Fehling's solution, the presence of decided quantities of lead causes a serious decrease in the percentage of sugar (compare also Abstr., 1895, ii, 143, 296). L. DE K.

Estimation of Cellulose. By GERHARD LANGE (*Zeit. angw. Chem.*, 1895, 561—563).—5—10 grams of the substance, fodder, for instance, is moistened with a little water, mixed with three times its weight of sodium hydroxide and another 20 c.c. of water, and then fused in a large, unglazed, porcelain crucible, partially immersed in an oil bath. After putting on a perforated lid, through which passes a thermometer, the temperature is raised to 175—180°, and kept so for an hour. The principle of the process is that, at this temperature, the cellulose is not chemically acted on by the alkali. After slight cooling, the contents are digested in dilute sulphuric acid, and, after again rendering alkaline with soda, the whole is introduced into a large centrifugal tube and thoroughly whirled. The cellulose rapidly separates, and, after pouring off the supernatant liquid, it is once more washed by whirling with hot water, then washed with alcohol and ether, dried, and weighed. Allowance must be made, as usual, for any mineral matter. If the sample should be rich in fat, this may with advantage be first extracted. L. DE K.

Forensic Chemistry. By GEORG DRAGENDORFF (*Arch. Pharm.*, 1895, **233**, 612—630).—The ethereal salts of guaiacol, naphthol, cresol, &c., are readily extracted from their acid aqueous solutions by light petroleum or benzene, but, when mixed with large quantities of organic matter, are best first separated from the latter by means of alcohol.

Guaiacol benzoate (benzosol), when moistened with concentrated sulphuric acid, yields a reddish-purple colour with acetone; with ferric chloride a violet colour, striped with green and violet-blue; an orange and green colour with nitric acid; a green, violet, and yellow colour with potassium nitrite; a bright red colour with cane or grape sugar; a violet to red colour with Fröhde's reagent; and a violet, green, and blue colour with sulphovanadic acid. Guaiacol salicylate yields a violet colour with ferric chloride and a bright red colour with concentrated sulphuric acid, changing to green, violet, and red on the addition of nitric acid. When moistened with concentrated sulphuric acid, it is coloured green, blue, and red by potassium nitrite, and bright red by acetone. Sulphovanadic acid gives a bluish-black colour, Fröhde's reagent, a violet, changing to green. Guaiacol cinnamate dissolves in concentrated sulphuric acid with a yellow colour, changed to orange by nitric acid, to violet and green by potassium nitrite, and to violet by acetone. Guaiacol cinnamate is less soluble in light petroleum than the salicylate, and is further distinguished from the latter by its ready conversion into benzaldehyde by alkaline permanganate. Guaiacol itself, when pure, dissolves in concentrated sulphuric acid, yielding a colourless solution, which is coloured red to brown by nitric acid, violet and green by potassium nitrite, green by potassium selenate, blue-green and violet by sulphovanadic acid. With Fröhde's reagent, guaiacol yields a green and violet colour; with alcoholic ferric chloride, a blue and emerald-green colour; and with permanganate and hydrochloric acid, a cherry-red to brown colour. It is coloured green by aqueous ferric chloride, and the spectrum of the solution shows an absorption band in the red and orange (654—610 μ), a slight shading at 595 μ, and a further slight absorption in the violet and indigo up to 450 μ.

Alphol (α-naphthylic salicylate) dissolves in concentrated sulphuric acid with a yellow coloration, changed to blue, green, and red by nitrates and nitrites; conversely, the reaction serves as a delicate test for these salts. The absorption spectrum shows a band from the violet to the green (500 μ), and a band in the red (680—650 μ). A mixture of alphol and concentrated sulphuric acid is coloured purple by aqueous furfuraldehyde, and cherry-red by cane sugar, the colour in the latter case being changed to blue by ammonia. The sulphuric acid mixture is turned green by ferric chloride, yellow by acetone, and fluorescent green by iodoform. Fröhde's reagent gives a green coloration with alphol, sulphovanadic acid a green colour, changed to reddish-brown by the addition of water, and sulphuric acid with ammonium uranate green, changing to greyish-brown on heating. Alcoholic alphol is coloured violet by ferric chloride, and, on warming, blue by chloroform and caustic soda.

Betol (β-naphthylic salicylate) dissolved in concentrated sulphuric acid yields a characteristic colour on the addition of a crystal of chloral hydrate, the orange coloration at first produced changing to reddish-violet and then to red with green fluorescence. The other reactions resemble those of its isomeride.

β-Naphthylic benzoate is coloured yellow by concentrated sulphuric acid, but dissolves, on warming, to a violet solution, having a green fluorescence. This solution is coloured dark brown by nitric acid, and, by potassium nitrite, violet, changing to red and blue; it is coloured violet and red by ferric chloride, bluish-violet by ammonium molybdate, changing to red, green, and blue; violet by Fröhde's reagent and sulphovanadic acid, the colour in the latter case changing to red and blue; green to orange by chloral hydrate, purple to violet by aqueous furfuraldehyde, violet by the sugars, and yellow by acetone. The benzoate is coloured blue when heated with chloroform and alcoholic soda. β-Naphthylic carbonate gives much the same reactions as α- and β-naphthol.

The tolylic benzoates and salicylates give reactions of the same character as the corresponding salts of guaiacol. The reactions of various amido-derivatives, such as paracetamidophenylic salicylate, are also described in similar detail. JN. W.

Detection of Formaldehyde. By G. ROMYN (*Ned. Tydschr. Pharm., &c.*, 1895, **7**, 169—175).—The article of food, milk for instance, is submitted to distillation. Although a portion of the formaldehyde is retained by the albuminous matters, a little of it is sure to pass over with the distillate, and may then be identified as follows. A drop of the liquid is mixed on an object glass with a drop of ammonia, and evaporated to dryness; the crystalline residue, when examined under the microscope, will be found to consist, not of rhombohedra, but of regular crystals if formaldehyde was present. It is then moistened with water, and treated with either of the following reagents.

Mercuric chloride in excess at once gives a precipitate; in a short time, three, four, or six-sided stars are noticed, afterwards octahedra. This test still shows at a dilution of 1—100,000.

Potassium mercuric iodide and dilute hydrochloric acid give hexagonal, six-angled, pale-yellow stars; this reaction is obtained at a dilution of 1—10,000, but not when it reaches 1—100,000.

Platinic chloride gives regular octahedral crystals, much resembling ammonium platinochloride, but darker in colour; the reaction is just visible at a dilution of 1—10,000.

Phosphomolybdic acid gives right, rhombic crystals, very characteristic at a dilution of 1—10,000.

Potassium bismuth iodide and dilute hydrochloric acid gives regular crystals, mostly octahedra. The yellow precipitate is formed at once, at a dilution of 1—1,000; but only slowly when at a dilution of 1—10,000.

Stannous chloride and strong hydrochloric acid give rhombic needles and crystals. The reaction is very strong in a 1 per cent. solution, and just visible when at a dilution of 1—1,000.

Potassium iodide containing iodine gives rectangular plates and aggregations of the rhombic system, very distinct at a dilution of 1—1,000, but no longer visible at 1—10,000.

Picric acid gives needles, probably rhombic. When the dilution reaches 1—1,000, they only form after some time. L. DE K.

Volatility of Fatty Acids and Laws Deduced therefrom. By HENRY DROOP RICHMOND (*Analyst*, **20**, 193—198; 217—219).—The author has tabulated a number of results obtained by distilling the mixed fatty acids of butter under varying conditions, and mathematical equations are given to explain the results. It appears that in the well-known Reichert-Wollny process only about 87 per cent. of the total volatile acids is found in the distillate. L. DE K.

Estimation of Uric acid in Urine. By MARTIN KRÜGER (*Zeit. physiol. Chem.*, 1895, **21**, 311—318).—The following method, based on the author's previous work, is recommended. One hundred c.c. of urine is taken, and the nitrogen of the uric acid, *plus* that of alloxuric bases, estimated. This is done by adding to the boiling urine 10 c.c. of sodium hydrogen sulphite solution, 10 c.c. of copper sulphate (10 per cent.) solution, and 5 c.c. of barium chloride (10 per cent.) solution. The mixture is boiled for three minutes, and allowed to remain two hours; the precipitate is then collected, washed with hot water, and its nitrogen estimated by Kjeldahl's method. In another specimen, the urine is first freed from uric acid by adding sodium carbonate until a flocculent precipitate forms, and then 5 c.c. of 10 per cent. acetic acid is added. The nitrogen of the alloxuric bases is then estimated, and this, subtracted from the nitrogen obtained in the first experiment, gives the uric acid nitrogen by difference.

There are various safeguards introduced when this is applied to pathological urines. The results given come out very nearly the same as those obtained by the standard Salkowski-Ludwig process.

W. D. H.

Iodine and Bromine Absorptions of Linseed Oil. By ROWLAND WILLIAMS (*Analyst*, **20**, 276—277).—The author states that the iodine absorption of raw linseed oil is much higher than is generally believed. An examination of several hundred samples of undoubtedly genuine origin gave figures varying from 180 to 190 per cent. of iodine. The author attributes the low figures of other observers to the fact, which is not sufficiently appreciated, that it is absolutely necessary to use a large excess of the Hübl reagent, and to let this act for at least 18 hours.

As regards the bromine absorption, the author strongly recommends the gravimetric process proposed by Hehner (Abstr., 1895, ii, 428), as the results are more trustworthy than those obtained by the volumetric method. When applying the iodine or bromine absorption process to the assay of boiled linseed oil, it must be remembered that both absorptions are considerably lessened by the boiling.

L. DE K.

Saponification in the Cold. Saponification Numbers and Reichert-Meissl Numbers. By ROBERT HENRIQUES (*Zeit. angw. Chem.*, 1895, 721—724).—The author recommends the following modification of the Reichert-Meissl process. Five grams of the fat is put into a porcelain dish, and dissolved in 25 c.c. of light petroleum, 25 c.c. of 4 per cent. alcoholic soda is added, and the dish is covered, and allowed to remain over night; the liquid is then evaporated to complete dryness on the water-bath, and the powder transferred to the distilling flask. After rinsing the basin with the prescribed amount of water, the process is conducted as usual. No volatile ethereal salts are formed in the cold process. The small amount of carbonic anhydride absorbed from the air does not influence the result. The process may also be used for taking the saponification number; for this purpose the fat is dissolved in a stoppered flask as directed, allowed to remain for 24 hours, and the excess of alkali titrated; if the mass should have become somewhat too solid, the addition of some more alcohol and gentle warming will be found useful. Wax must be dissolved in hot, light petroleum (boiling point, 100—150°) before adding the soda. L. DE K.

Estimation of Tannin in Wines. By E. MANCEAU (*Compt. rend.*, 1895, **121**, 646—647).—No method of precipitation with soluble gelatin or a metallic salt will remove the whole of the tannin from a solution; this can only be effected by means of animal membranes, such as the gut cords used in Girard's process. The sensitiveness required in dealing with dilute solutions like wines is obtained by combining Girard's process with the use of permanganate.

One hundred c.c. of champagne or other wine containing a similar quantity of tannin (or of stronger wines previously diluted with a known volume of water) is allowed to remain in contact with 1 gram of gut cords for about a week in a well-closed flask. The liquid is then titrated by means of permanganate solution, 1 c.c. of which is equivalent to 0·02 milligram of pure gallotannin, indigo solution being used as the indicator. The difference between the volumes of permanganate solution required by a given volume of wine before and after the removal of the tannin gives the quantity of œno-tannins present, in terms of gallotannin. In champagnes, the quantity varies from 8 milligrams to 50 milligrams per litre.

The gut cords for this process are prepared by washing unoiled violin strings with dilute alcohol, dilute acids, and water until these solvents no longer remove anything that reduces potassium permanganate. C. H. B.

Titration of Alkaloïds with Iodine Solution. By CARL KIPPENBERGER (*Zeit. anal. Chem.*, 1896, **35**, 10—27).—In a former paper (Abstr., 1895, ii, 465), it was stated that when a salt of an alkaloïd is mixed with a solution of iodine in potassium iodide, only the free iodine is concerned in the formation of the alkaloïd periodide, Alk,HI,I_2, three atoms of iodine being consumed for each molecule of alkaloïd. The author now investigates the reaction more closely. When the iodine solution is prepared with the smallest possible quantity of potassium iodide, the results present considerable irregularities: the precipitate contains free iodine in larger or smaller amount as the excess of iodine solution used is larger or smaller; the amount of potassium iodide decomposed is sometimes larger and sometimes smaller than would correspond with the equation $Alk,HCl + KI + I_2 = Alk,HI,I_2 + KCl$: and the amount of free iodine consumed is considerably larger than is the case when more iodide is present. By adding either a large excess of hydriodic acid or of potassium iodide, especially when the free acid in the alkaloïd solution has been nearly neutralised, the consumption of free iodine falls, in the case of strychnine, to 2 atoms. With narcotine and atropine, the amount consumed is always more than 2 atoms, and varies somewhat with the conditions. For alkaloïds other than strychnine, it is therefore best to standardise the iodine solution against known quantities of alkaloïd under circumstances as closely as possible resembling those of the titration itself; but on this subject a further communication is promised. M. J. S.

Estimation of Creatinine in Urine. By Rudolf Kolisch (*Chem. Centr.*, 1895, i, 814—815; from *Centr. inn. Med.*, **16**, 265—269).—The estimation of creatinine has as yet received but little appreciation on account of the very imperfect analytical methods. The author proposes a new process. Two hundred c.c. of urine is precipitated with 20 c.c. of a mixture of calcium chloride and milk of lime and filtered. Two hundred c.c. of the filtrate is acidified with acetic acid, evaporated to a thick syrup, and the residue while still warm is exhausted four or five times with alcohol. The solution is diluted in a graduated flask to 110 c.c., and 100 c.c. is then used for precipitation with mercuric chloride solution, after first acidifying with acetic acid. This mercury solution is prepared by dissolving 30 grams of mercuric chloride, 1 gram of sodium acetate, and 3 drops of acetic acid in 125 c.c. of absolute alcohol.

After adding enough of this solution to precipitate all the creatinine, the precipitate is washed on a filter with absolute alcohol containing a little sodium acetate until the washings no longer become turbid when neutralised, showing that all the urea has been removed. The creatinine is now calculated from the amount of nitrogen contained in the precipitate, which is best estimated by using Kjeldahl's process. Its percentage is finally found by multiplying by 100/81. L. de K.

Assay of Opium. By David B. Dott (*Pharm. J. Trans.*, 1894, [3], **24**, 847).—Ten grams of powdered opium is digested with 25 c.c. of water, 1·8 grams of barium chloride dissolved in 12 c.c. of water added, and the whole made up to 50 c.c., mixed, and, after a short time, filtered. To half the filtrate, representing 5 grams of opium, just enough sulphuric acid to precipitate the barium is added, and to the filtrate from this, enough ammonia to neutralise the free acid. The solution is then concentrated to 6—7 c.c., and allowed to cool; 1 c.c. of alcohol and 1 c.c. of ether are next added, then ammonia in slight excess. After three hours, the precipitate is collected on a tared filter, dried, washed with benzene or chloroform, dried, and weighed. It is then titrated with N/10 acid, until the morphine is neutralised, as indicated by the solution reddening litmus paper. One c.c. of N/10 acid = 0·0303 gram of morphine hydrate. R. R.

Estimation of Aconitine. By John C. Umney (*Pharm. J. Trans.*, 1895, [3], **25**, 860).—A definite weight of aconitine is hydrolysed by heating on a water bath for two hours with a known volume of a standard alcoholic solution of caustic alkali, in a reflux apparatus. By this treatment, it is resolved into aconine, and acetic and benzoic acids, the latter combining with the alkali present; the amount of the acids can then be found by titrating the uncombined alkali. The solution is again made alkaline, the alcohol evaporated off on a water bath, and sufficient hydrochloric acid added to separate the benzoic acid, which is extracted by successive washings with ether, weighed, and the quantity of alkali required for its neutralisation in the first part of the process calculated. By deducting this from the total amount, the quantity of acetic acid is found, and the amount of crystalline aconitine is thus determined. R. R.

Assay of Ipecacuanha. By RICHARD A. CRIPPS (*Pharm. J. Trans.*, 1895, [3], **25**, 1093—1094).—The author refers to Paul and Cownley's investigations, and mentions the presence in ipecacuanha of a fourth alkaloïd, noted by himself in 1891; he has sought in vain for Arndt's volatile alkaloïd. He finds that the proportion of the third alkaloïd to the emetine and cephaeline taken together may vary from one-twentieth to one-fourth, and thinks that ipecacuanha, like other drugs containing several alkaloïds, contains them in varying proportions. In an assay, therefore, the total alkaloïds should be taken into account. Lyons' process should be the one recognised, and only the Brazilian root be official, this being required to yield not less than 2·0 nor more than 2·5 per cent. of alkaloïds. A table shows many different assays and their divergent results. R. R.

Ehrlich's Diazo-reaction. By RICHARD T. HEWLETT (*Brit. Med. J.*, 1896, i, 136—137).—Several modifications have been proposed in the original method of testing with sulphanilic acid and sodium nitrite. The reaction is invariably given by the urine in typhoid fever, although occasionally it is seen in other diseases also.

Attention is drawn to the fact that the test solutions must be freshly prepared before using.

The nature of the substance in the urine that gives the reaction is uncertain, and of a large number of materials examined, morphine was the only one which gives a similar red reaction, but no green precipitate forms on standing. One part of morphine in 10,000 of water gives the test. W. D. H.

Colour Reactions of Proteïds with Nitrous acid and Phenols. By KARL LANDSTEINER (*Chem. Centr.*, 1895, i, 695; from *Centr. f. Physiol.*, **8**, 773—774).—The colour obtained by the action of nitrous acid and phenols on proteïds is attributed by Obermayer to the formation of diazo-compounds. The author, however, explains the reaction as follows: By acting on the hydrochloric acid solution of tyrosine, first with nitrous acid, then with alkali, and finally with α- or β-naphthol, a bluish-red colour is obtained. This reaction is not caused by the amido-group contained in the tyrosine, as parahydroxybenzoic acid also gives the test. Proteïds undoubtedly first yield tyrosine when the reaction is applied. L. DE K.

General and Physical Chemistry.

Relation between the Intensity of Light and its Action on Mixtures of Ferric Chloride and Oxalic acid. By Georges Lemoine (*Compt. rend.*, 1895, **121**, 817—819).—The author has investigated the relation between the visual intensity of light and its action on mixed solutions of ferric chloride and oxalic acid, using a system of two large polarising prisms as a means of varying the intensity of the light incident on the small cell containing the liquid. He finds that the chemical change produced is proportional to the visual intensity of the light; that there is no sensible "period of induction," the result being the same whether an exposure of a given total duration is intermittent or continuous; and that on cloudless days, the visual intensity of the sunlight remains practically constant for comparatively long periods (compare Abstr., 1895, ii, 249).

C. H. B.

New Molecular Refraction Formula. By F. Zecchini (*Gazzetta*, 1895, **25**, ii, 269—284).—The author has calculated the observed and theoretical molecular refractions of a long series of compounds of different types, using the formula $\frac{n^2 - 1}{(n^3 + 2)d}$. The values calculated from the set of atomic refractions given, agree well with the observed molecular refractions, but the formula is not independent of the temperature.

W. J. P.

Relations between the Composition and Absorption-spectra of Organic Compounds. By Gerhard Krüss (*Zeit. physikal. Chem.*, 1895, **18**, 559—562).—An addition to the late author's previous communication on this subject (Abstr., 1888, 1141). The paper contains the observations on the absorption-spectrum in the case of alizarin, purpurin, quinizarin, hystazarin, anthraflavic acid, and a number of their derivatives.

L. M. J.

Anomalies in the Rotatory Dispersion of Malic acid. By Raffaele Nasini and G. Gennari (*Zeit. physikal. Chem.*, 1896, **19**, 113—129).—Anomalies having been previously observed in the rotation of this acid, the authors investigated the optical phenomena by means of a Landolt-Lippich polarimeter. The effects of temperature, concentration, and of the addition of boric acid, in aqueous solutions were investigated, and solutions were examined in methylic, ethylic, and propylic alcohols, and in acetone. The phenomena in aqueous solutions were very complicated; dilute solutions were lævorotatory and normal; by increase of concentration, a lævorotatory, achromatic solution was first obtained, then a lævo-maximum in the yellow, after which the more refrangible rays gave a dextrorotation, whilst for the highest concentrations, the solutions were normally dextrorotatory. Increase of temperature had an effect analogous to dilution, whilst in the organic solvents the dilute solutions were lævorotatory, but the concentrated solution gave dextrorotations for the more refrangible rays. It is evident that such variations are associated with great changes in the dispersion. The probable cause of these results is discussed; the presence of two compounds of different dispersion coefficients and opposite rotatory power is sufficient to explain the results, but the nature of the two compounds does not seem clear. The authors do not consider as probable the formation of hydrates, or polymerides, or the existence of "crystalline molecules" (compare Abstr., 1893, ii, 103), neither does dissociation appear entirely satisfactory. The explanation regarded as most probable is that of a specific action of the solvent in which the molecular dissymmetry is altered or destroyed, so that the compound may acquire physical properties approximating to those of its ions without being actually dissociated. In the alcoholic solutions, in an analogous manner, the approximation is to the lævorotatory ethereal salts of malic acid (Abstr., 1895, ii, 251). L. M. J.

Rotatory Dispersion of Nicotine and its Salts. By G. GENNARI (*Gazzetta*, 1895, **25**, ii, 252—257; also *Zeit. physikal. Chem.*, 1896, **19**, 130—134).—In continuation of the work of Gennari and Nasini (this vol., ii, 133), the author has examined the specific rotations of nicotine, and its sulphate, hydrochloride, and acetate under various conditions of concentration and solvent, for five different wave-lengths, using Landolt's ray filters.

At 20°, pure nicotine of sp. gr. = 1·01071 at 20°/4° has the specific rotations of −123·37°, −162·84°, −209·78°, −250·71°, and −317·79°, for the ray filter colours *rt*, D, *gr*, *hb*, and *db* (compare Abstr., 1895, ii, 1) respectively; the specific rotations are considerably lower in benzene and ethylic and methylic alcoholic solutions, and very much lower in aqueous solutions, the specific rotation diminishing as the dilution increases. The solutions, however, are all lævorotatory, and the coefficients of rotatory dispersion calculated as $[\alpha]_x/[\alpha]_y$ for the various rays are the same for nicotine, both pure and in solution. The specific rotations of the various salts examined at 20° are given in the following table.

Salt.	Concentration, per cent.	$[\alpha]_{rt}$.	$[\alpha]_D$.	$[\alpha]_{gr}$.	$[\alpha]_{hb}$.	$[\alpha]_{db}$.
Sulphate........	31·420	+12·19	+15·66	+19·20	+21·82	+24·74
Hydrochloride...	18·414	+12·13	+15·45	+18·72	+21·88	+23·84
Acetate.........	24·276	+13·00	+16·96	+20·40	+23·50	+25·84

It will be seen that the salts are all dextrorotatory in aqueous solution, and the rotatory dispersions are found to be less than those of nicotine itself.

A mixture of nicotine and acetic acid, in molecular proportion, is strongly lævorotatory, but, on gradual dilution with water, the lævorotation decreases until the solution becomes highly dextrorotatory. This can only be explained by supposing that, as the acetic acid solution is diluted, more and more of the dextrorotatory acetate is formed, whilst the proportion of lævorotatory base decreases. W. J. P.

Rotatory Power of Superfused Rhamnose. By DÉSIRÉ GERNEZ (*Compt. rend.*, 1895, **121**, 1150—1152).—The specific rotatory power of rhamnose at 18° is $-6.5°$ a minute after dissolution, but attains the constant value of $+9.75°$ in less than an hour. Direct measurements of the sp. gr. and specific rotatory power of the superfused rhamnose, $(C_6H_{12}O_5 + H_2O)$ gave the following results.

t°.	0°.	16°.	18°.	19°.	46°.	70°.	73°.	100°.
Sp. gr.	1·400	1·388	1·387	1·386	1·357	1·349	1·346	1·325
Sp. rot. power..	9·28°	8·66°	8·59°	8·53°	7·57°	6·73°	6·64°	5·70°

The observations are accurately represented by the expression

$$[\alpha]^t_D = 9{\cdot}22° - 0{\cdot}03642t + 0{\cdot}0000123t^2.$$

The rotatory power of the superfused rhamnose diminishes regularly as the temperature rises, and at 100° has only 61 per cent. of its value at 0°. Its specific rotatory power in aqueous solution is not identical with that of the superfused substance, and this difference must be taken into account in any attempts to explain multirotation. C. H. B.

Flames and Illuminating Gases. By JOSEF M. EDER (*Zeit. physikal. Chem.*, 1896, **19**, 20—24).—The author criticises various points in Bohn's communication (this vol., ii, 140), and calls attention to the fact that several of the observations and conclusions had been previously recorded by himself. L. M. J.

Luminosity of pure Inorganic Compounds and of Solid Solutions. By EILHARD WIEDEMANN and GERHARD C. SCHMIDT (*Zeit. physikal. Chem.*, 1895, **18**, 529—552).—Many inorganic, as well as organic, compounds (this vol., ii, 86) become luminous when subjected to the influence of the cathode rays, frequently exhibiting also an after-luminosity, and possessing the property of again becoming luminous when heated. The effect of the cathode rays on pure compounds is first considered, and tables of the luminosity phenomena are given. The luminosity colour of the salts appears to be dependent on the metal, the acid only influencing the intensity of the light. In solid solutions, a small quantity of the dissolved substance may cause a great alteration of the colour and intensity, both of which are also dependent on the solvent, whilst the intensity is, in dilute solution, a direct function of the concentration. The previous heating of the compound almost invariably influences the phenomena, either owing to chemical changes so occasioned, or to alteration of the physical state, whilst the after-luminosity is also of longer duration. At high temperatures, the luminosity still remains, but the after-effects decrease or disappear, and the colour usually changes to a more refrangible shade, whilst at low temperatures, the luminosity is brighter and the after-effect of longer duration. The physical modification which is produced by these cathode rays appears to be usually of a fairly stable nature, being only destroyed by relatively high temperatures (200° and above), whilst at ordinary temperatures the thermo-luminosity may last over six months, although in some cases it is lost in a week. The addition of foreign substances may cause either an increase or a decrease of luminosity, both in the case of pure compounds and of solid solutions. Experiments on phosphorescence showed that the phosphorescence colour is the same as that of the cathodic luminosity, and that it also is frequently destroyed by foreign substances, whilst Stokes' rule was found to be valid for all the solid solutions examined. The paper concludes with a brief theoretical consideration of the observed facts. L. M. J.

Dependence of the Dielectric Constant on Temperature and Pressure. By FLORIAN RATZ (*Zeit. physikal. Chem.*, 1896, **19**, 94—112).—The dielectric constant was determined at various temperatures and pressures by Nernst's method (Abstr., 1894, ii, 437), in the case of benzene, toluene, carbon bisulphide, ethylic ether, chloroform, aniline, amylic alcohol, ethylic alcohol, and water. The value $(D - 1)/(D + 2)d$ is a function of both temperature and pressure, the temperature coefficient increasing with the dielectric constant. The variation between the values of the constant obtained from the formula and the actual number is, for a temperature of 30°, below 10 per cent., and the value of the above expression within 40° changes by less than 5 per cent. The temperature coefficient is small, and in all cases negative, decreasing slightly as the temperature rises. No maximum for D is found at 4° in the case of water, and if such exists at all, it must be between 0° and 1°. In all cases, the value of D is greater than A^2 obtained from refraction observations. The pressure coefficient is small and positive, so that it follows that the influence of temperature is greater, and that of pressure less, than the calculated effect. Details of the method, the purification of the compounds examined, and the experimental numbers are given in the paper. L. M. J.

The Dilution Law of Electrolytes. By LUDWIG STORCH (*Zeit. physikal. Chem.*, 1896, **19**, 13—19).—The author has obtained a dilution law of the form $\left(\frac{\mu}{v\mu_\infty}\right)^x = k\left(\frac{\mu_\infty - \mu}{v\mu_\infty}\right)^m$,* where μ_∞ and μ are the molecular conductivities at infinite dilution and volume v respectively. This may be expressed as $x \log(\mu/v) = \log(\overline{\mu_\infty - \mu}/v) + \log(k\mu_\infty{}^{x-1})$. By the construction of curves with Kohlrausch's values for μ/v, and a probable μ_∞, values for x and $(k\mu_\infty{}^{x-1})$ are obtained, and hence, by recalculation, the actual value of μ_∞. The value for x differs for different electrolytes, but in the 12 cases considered varies only between 1·400 and 1·577, and the conductivities then calculated from the formula agree very closely with the observed numbers. It is seen that the above formula for the value $x = 1·5$ is identical with that obtained by van't Hoff from Rudolphi's numbers (compare this vol., ii, 145). For very high concentrations, however, the formulæ are not valid; thus, from $v = 0·33$, 1 and 2, the values $x = 1·699$ $\mu_\infty = 104$ were obtained for potassium chloride, the corresponding values derived from $v = 10$ to 16667 being 1·435 and 122; the lower values for μ_∞ probably indicate the presence of double molecules in the more concentrated solutions. L. M. J.

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* There appear to be misprints in the formulæ as printed in the *Zeitschrift*; the equation given is obtained by recalculation from the final form.

Specific Heats of Solutions. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1895, **18**, 625—644).—Observations have shown that the heat capacity of solutions, if not too dilute, is generally smaller than that of the two components, and frequently less than that of the water alone. The heat capacity of the water has, however, been calculated without due provision for the alteration of the specific heat, owing to the change in the internal pressure. The alteration of specific heat by pressure change being given by the equation $(dC/dp)(T\ \text{const.}) = -T(d^2v/dT^2)(p\ \text{const.})$, that due to the solution in water of any compound is given by a similar equation, where $p = \Delta K$; the alteration of internal pressure (see Abstr., 1895, ii, 307, and previous abstracts). If the expansion of the solution be given by $v = A + at + bt^2$, which holds for small temperature changes, then $d^2v/dt^2 = 2b$, and is determined from Amagat's experiments to be a linear function of p, and the value is obtained at various temperatures. The value for the specific heat is thus obtained, and, on adding the heat capacity of the water to that of the salt in solutions of potassium chloride, bromide, iodide, nitrate, and hydroxide; hydrogen chloride, nitric and sulphuric acids; sodium sulphate, nitrate, and hydroxide; ammonia, ammonium sulphate, magnesium sulphate, and barium chloride, results are obtained in very close approximation to the experimental determinations, except in the cases of sodium chloride and sulphuric acid. The changes due to alteration of ΔK with temperature are considered, but cause no appreciable difference. Similar reasoning is applied to the cases of neutralisation, where the heat capacity of the salt solution formed is not the sum of those of the added acid and base together with that of the water formed by neutralisation. When corrections due to the alteration of internal pressure are applied, concordant results are obtained. The changes in the specific heat of solutions due to temperature alterations are also considered, and found to be of the order indicated by the early experiments of Marignac. L. M. J.

Relationship of the Heats of Vaporisation of Gases to their Densities, and also to their Boiling Points. By WILLIAM L. DUDLEY (*J. Amer. Chem. Soc.*, 1895, **17**, 969—986).—The author has proved, by a series of experiments on substances belonging to the fatty and aromatic series, that in any homologous series the heat of vaporisation in a unit of volume of the vapour under the same conditions as to temperature and pressure is proportional to the density, and also to the absolute boiling point.

The characteristic of the curve is dependent on the acid radicle; that is, the acid radicle is the basis of the structure of the molecule, and the bases in combination with it do not alter the general molecular architecture. L. DE K.

The Physical Alteration of certain Sulphur Compounds at Temperatures below their Melting Points. By WALTHÈRE SPRING (*Zeit. physikal. Chem.*, 1895, **18**, 553—558).—Experiments analogous to those undertaken with metals (Abstr., 1895, ii, 37) were made on the sulphides of silver, arsenic, antimony, bismuth, copper, tin, cadmium, lead, and zinc. The amorphous sulphides obtained by precipitation were used, being first washed, dried, and *lightly* pressed into cylinders. The latter treatment was merely to bring the particles into contact, the pressure being so slight that the cylinders could be easily crumbled between the fingers. One half of the cylinder was kept for comparison, the other enclosed in an exhausted glass tube and exposed for nine days of 7—8 hours to a temperature of 265° (150° for the arsenic sulphide). The cylinder of silver sulphide, after this treatment, was steel grey, with a metallic lustre, and with crystal faces visible on the surface. It could not be broken by the hand, and, after forcible breaking, exhibited a crystalline fracture resembling that of steel. Similar results were also obtained with the other compounds. Uncompressed powders were also employed, which formed compact masses, with, usually, indications of a crystalline nature. The author points out the probable importance of these results in geology, as they indicate the possible formation of crystalline rocks, &c., without fusion or the aid of a solvent. L. M. J.

Melting Point of Organic Compounds. By BERNHARD VON SCHNEIDER (*Zeit. physikal. Chem.*, 1896, **19**, 155—158).—The melting points of a number of organic compounds were determined by the use of an alcohol thermometer and a freezing mixture of solid carbonic anhydride and ether. Corrections for the hotter portion of the stem are applied, and the following results obtained.

Ethylic oxalate	−41·0°	Benzonitrile........	−12·9°
Ethylenic dichloride.	−36·0	Diethylaniline......	−38·8
Ethylenic chlorobromide............	−16·6	Paraphenetidine....	+ 2·4
Ethylenic chloriodide	−15·6	Orthonitrotoluene ..	−14·8
Chlorobenzene......	−45·0	Anisoïl............	−37·8
Bromobenzene......	−30·5	Ethylthiocarbimide .	− 5·9
Iodobenzene	−28·5	Chloropicrin	−69·2
		Ethylic salicylate ..	+ 1·3

L. M. J.

The Apparent and True Freezing Point, and Freezing Point Methods. By MEJER WILDERMANN (*Zeit. physikal. Chem.*, 1896, **19**, 63—93).—The expressions deduced by Nernst and Abegg (Abstr., 1895, ii, 155) are incomplete, inasmuch as they do not take into account the heat (i) evolved by the precipitation of ice, (ii) absorbed by its solution. In the case of an air bath, the course of the temperature change owing to radiation, &c., is $dt/dz = c(t_z - t)$; that owing to stirring is $dt/dz = k'$, hence $dt/dz = c(t_s - t) + k'$ (i); and at the convergence temperature t_s, $dt/dz = c(t_z - t_s) + k' = 0$, and $t_s = t_s - k_1/c$, where t_z is temperature of the air bath and z the time, so that (i) becomes $dt/dz = c(t_s - t)$, agreeing with Nernst's deduction. If t_s is above the freezing point, then melting of ice occurs, and if t_f and t_o are the temperatures of the liquid and freezing point respectively, $dt/dz = k(t_o - t_f) + c(t_s - t_f)$; hence, when the temperature is constant, $t' = t_o + \frac{c}{k}(t_s - t')$, and t' the observed temperature must be higher than t_o, the actual freezing point, and less than t_s, the convergence temperature. In order that $(t_s - t)c/k$ may be small, c must be as small as possible, that is, the volume of the liquid should be great, and k should be large, which means that the surface of the ice should be great, and the ice, therefore, in fine needles and as large as possible, so that those determinations in which the readings are taken when the ice specks disappear are the worst possible. As the same formula applies to both pure water and the solution, the observed depression is given by $t_o - t'_o = \left(1 + \frac{c}{k}\right)(t' - t'')$ (if the values of c and k are equal for solution and pure water); so that the apparent values bear to the true values a constant ratio at all concentrations, if not too great. In the author's experiments, the results are hence only 0·1 per cent. too small, and the greatest error due to this cause in the work of various observers appears to be about 0·0048°. The author points out also the bearing on the results of the presence of an ice cap (compare Trans., 1895, 6, and Abstr., 1895, ii, 105).

Where the convergence temperature is below the freezing point, the temperature change is given by $dt/dz = c''(t_o - t_f) + c(t_s - t_f)$, which, by equating to zero, yields $t' = t_o + \frac{c}{c''}(t_s - t')$, so that t' lies between t_o and t_s. Experiments to find the value of the constants here and in the previous formulæ are recorded, and the result obtained that for a bath at −5° the value $c/c''(t_s - t')$ would not reach 0·003°, whilst for the freezing point depressions, that is, the difference of the corrections for solvent and solution, the values become still less. In this case, also, it is pointed out that the necessity of avoiding an ice cap no longer exists. L. M. J.

Method for the Determination of the Freezing Points of Concentrated Solutions. By MAX ROLOFF (*Zeit. physikal. Chem.*, 1895, **18**, 572—584).—The freezing point is determined by finding the composition of the solution which, at a determined constant temperature, remains in equilibrium with ice. The chief difficulty is the maintenance of the freezing mixtures at a sufficiently constant temperature, but this is overcome by the use of "cryohydrates" jacketed by colder freezing mixtures. Experiments with hydrogen chloride included observations on 22 solutions varying in concentration from 1·42 per cent. to 16·98 per cent. The molecular depression was found to increase from 36·7 to 61·9, a result accounted for by the positive heat of dilution of the solution. The values are compared with those obtained by Nernst, Jones, and Le Blanc and Noyes, the agreement being very close. In the case of potassium chloride solutions, the molecular depression decreased from 34·3 at 0·836 per cent. to 32·6 at 24·62 per cent., the values being again in satisfactory accord with those of Jones and Kistiakowsky. From the values also the osmotic pressures are calculated by means of the expression deduced by Arrhenius, the numbers being in satisfactory accord with those obtained by Dieterici from the alteration of the vapour pressures. By use of the values found for the osmotic pressure, the ratios of the vapour pressures of solvent and solution are also calculated, the numbers being in agreement with the measurements of Dieterici, Fischer, and Tammann, but not with those of Juhlin and Ramsay and Young. Researches with acetic acid gave a value for the molecular depression which decreased from 19·4 to 10·0, the fall below the normal value 18 being probably due to the formation of complex molecules. L. M. J.

The Freezing Points of Dilute Solutions. By WALTHER NERNST and RICHARD ABEGG (*Zeit. physikal. Chem.*, 1895, **18**, 658—661).—A reply to Jones (this vol., ii, 155), in which the authors point out that the correction of 20 per cent. must be allowed if found to be theoretically valid. Further the variations of 5 per cent. in their values for the sodium chloride depression are still within the errors of observation, and that the increase in the molecular depression of ethylic alcohol is also within the limits of observation.

L. M. J.

Exceptions to the Law of Freezing Point Depressions. By FELICE GARELLI (*Gazzetta*, 1895, **25**, ii, 173—178).—In continuation of the previous work of Garelli and Montanari (Abstr., 1895, ii, 205) on the anomalous depressions of the freezing point of a solvent produced by a dissolved substance of similar constitution, the author has examined the behaviour of a number of organic substances in various solvents.

Using paraxylene as the solvent (compare Paternò and Montemartini, Abstr., 1895, ii, 207), normal depressions are obtained with naphthalene, pyrroline, and piperidine; $\alpha\alpha$-dimethylpyrroline and $\alpha\alpha$-dimethylthiophen, however, in paraxylene, give molecular weights which are too high, just as pyrroline and thiophen do in benzene solution. Similarly, $\alpha\alpha$-dithionyl gives too high a molecular weight in diphenyl solution, whilst it behaves quite normally in freezing benzene (compare Auwers, Abstr., 1895, ii, 41).

Substances which are geometrical or position isomerides do not seem to form isomorphous mixtures or solid solutions, and therefore the one depresses the freezing point of the other quite normally. Thus apiole dissolved in isoapiole, and isocrotonic acid dissolved in crotonic acid give the theoretical molecular weights; the same is true of pyrocatechol and quinol dissolved in resorcinol. The molecular depression of the freezing point of resorcinol is found to be 65.

W. J. P.

Cryoscopic Behaviour of Substances of similar Constitution to the Solvent. By FELICE GARELLI (*Gazzetta*, 1895, **25**, ii, 179—188).—Anomalous cryoscopic behaviour may in any particular case be due to one of two causes. Some substances, such as alcohols, oximes, or phenols, which contain hydroxyl, tend to form complex molecular aggregates when dissolved in hydrocarbons, and their molecular weights approximate to the theoretical ones only in dilute solutions; further, when the dissolved substance and the solvent have analogous constitutions, a solid solution is formed as the solvent freezes out, and the results give no indication of the true molecular weight of the dissolved substance. Since both these causes may bring about anomalies, Paternò's criticisms (this vol., ii, 156) of Garelli and Montanari's previous results (Abstr., 1895, ii, 205) lose considerably in force; the fact that phenol and paraxylenol behave abnormally both in benzene and paraxylene solutions is not surprising, as phenol would tend to form solid solutions in benzene solution, whilst in paraxylene solution it would tend to form molecular aggregates. The kind of abnormalities observed are in agreement with this view.

The observation of Ampola and Manuelli (this vol., ii, 238) that chloroform has the normal molecular weight in bromoform solution is not at variance with the author's views, for he has not hitherto observed the formation of solid solutions amongst aliphatic compounds (Abstr., 1894, i, 157); it may also be remarked that chlorobenzene and bromobenzene behave quite normally in benzene solution. W. J. P.

The Cryoscopic Behaviour of Substituted Phenols in Naphthalene. By Karl Auwers [and W. R. Innes] (*Zeit. physikal. Chem.*, 1895, **18**, 595—624).—Cryoscopic experiments on hydroxy-compounds in benzene have been previously recorded (Abstr., 1894, ii, 133; 1895, ii, 41), and the observations are here extended to solutions of such compounds in naphthalene. In order to prevent changes in the thermometric readings due to alteration of the freezing point, the thermometers were maintained between the experiments at a temperature of 80°, that is, close to that of the actual experiments. The molecular depression for naphthalene being uncertain (previous determinations varying from 85 to 70), it was redetermined by experiments with benzile, benzilosazone, and ethylic ethanetetracarboxylate. The values thus obtained vary between 68·25 and 69·3, mean 68·92, agreeing well with the value 69, calculated by van't Hoff's formula, which is afterwards employed.

Experiments were made with 52 homologous and substituted phenols, and the following general relations observed. (I) Ortho-substituted phenols are cryoscopically normal, para-derivatives abnormal, whilst meta-derivatives occupy an intermediate position, but approximating more towards the para-compounds. (II) A substituting group in the ortho-position may hence be said to exert a "normalising" influence, the reverse obtaining for a group in the para-position, the extent of this influence depending on the nature of the group. In this respect, the aldehyde group CHO exerts the greatest influence; then in order—carboxalkyl, COOR; nitro-group; halogens; alkyls. (III) Other conditions being similar, the ortho-group has a stronger influence than the para- or meta-, so that, for instance, ortho-nitrophenol is normal, para-nitrophenol abnormal, and orthopara-dinitrophenol normal. The cryoscopic behaviour of a com-

pound, therefore, unless further observations prove the rules to be not general, may be used to determine the constitution or orientation. The cause of these peculiarities is very uncertain, but the author points out some possible explanations. The abnormal values may be due to double molecules; these are not formed, however, in the case of ortho-compounds owing to the hindrance to the approach of the molecules, caused by the ortho-substituent. Or it may be due to a difference in constitution analogous to that indicated by Armstrong (Proc., 1892, 102). **L. M. J.**

New Method for the Determination of the Density of Gases. **By Henri Moissan and Henri Gautier (*Ann. Chim. Phys.*, [7], 5, 568—573).—The principle made use of in this method is the same as that of the Dumas' vapour density method. The difference in weight between a given volume of gas, measured under given conditions of temperature and pressure, and the same volume of air measured under the same conditions is determined.**

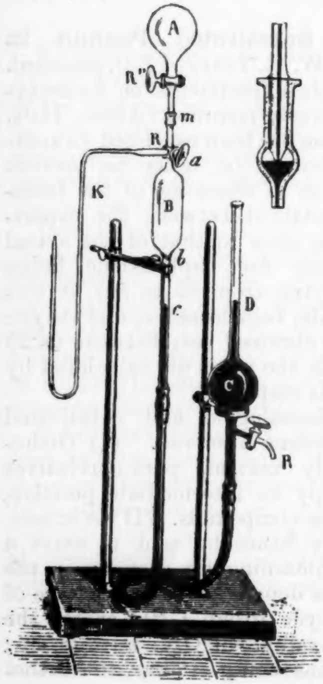
$$p = v \times 0{\cdot}001293(x - 1) \times \frac{H}{760} \times \frac{1}{1 + 0{\cdot}00367t}.$$

where p = difference between the two weights expressed in grams,

v = the volume of gas and of air,

t = temperature and, H = pressure under which the volume is measured.

Then x = density of the gas.



The apparatus used is represented in the accompanying cut.

A is the globe in which the air or gas is weighed; it carries a three way cock, R'' and can be attached by means of an air-tight joint to the measuring vessel, B, which also has a three-way cock, R. K is a capillary tube, by which the gas to be investigated is introduced into B. The measuring vessel, B, is graduated on the stem *bc*, and has a capacity of about 95 c.c. The pressure is brought to the atmospheric by regulating the amount of mercury in D. The globe A is exhausted, and then filled with carefully dried air. This operation is repeated some 10 times, and then the cock R'' is turned off. B and K are completely filled with dry mercury, and the point of K is then introduced into the vessel containing the gas to be examined, and

about 100 c.c. of gas are introduced into B, and the cock R is then turned, so as to shut off the measuring vessel from the rest of the apparatus, and the mercury in *c* and D is brought to the same level. The whole apparatus is then left for 6—7 hours, or still better over night, to attain a constant temperature. The temperature, volume, and pressure are then read, care being taken to see that the gas is at the atmospheric pressure. The cock R″ is opened for a moment, in order that the air in A may assume the atmospheric pressure. A is then removed and weighed; it is afterwards exhausted, and again connected with B. The cocks R and R″ are slowly opened, and the whole of the gas in B is made to pass into the globe, A, which is again detached, cleaned, and weighed.

The authors have determined the vapour densities of pure samples of carbonic anhydride, hydrogen, oxygen, and nitrogen, and they find that the numbers agree extremely well with those obtained by Regnault. J. J. S.

Vapour Tension of Hydrated Salts and the Constitution of the Combined Water. By WILHELM MULLER-ERZBACH (*Zeit. physikal. Chem.*, 1896, **19**, 135—154).—The tension of aqueous vapour was determined, in the case of a number of hydrated salts, by finding the specific gravity of the sulphuric acid solution with which the salt remained in equilibrium, preliminary approximation being first made. The values for the vapour tension fall suddenly at definite changes of hydration for most salts, so that between certain limits of hydration the vapour tension remains constant. The results obtained were as follows, the vapour pressure being referred to that of water at the same temperature:—Barium chloride, 1—2 aq. 0·21, 0—1 aq. 0·10; copper sulphate, 3—5 aq. 0·31, 1—3 aq. 0·20; 0—1 aq. below 0·02; zinc sulphate, 6—7 aq. 0·55, 1—6 aq. 0·50, 0·1 aq. below 0·02; disodium hydrogen phosphate, 7—12 aq. 0·75, 3—7 aq. 0·58, 0—2 aq. 0·06. L. M. J.

The Dilution Law for Salt Solutions. By FRIEDRICH KOHLRAUSCH (*Zeit. physikal. Chem.*, 1895, **18**, 662).—Van't Hoff has shown that, according to Rudolphi's experiments, the expresssion C_i^3/C_s^2 leads to a constant value where C_i and C_s are the concentration of ions and undissociated compound (1895, ii, 490; this vol., ii, 145). This expression may be written $C_i/C_s = \text{const.}/C_s^{\frac{1}{3}}$, that is the ratio of the undissociated compound to ions is proportional to the linear density of the former. L. M. J.

Partition of a Substance between Two Solvents. By A. A. JAKOWKIN (*Zeit. physikal. Chem.*, 1895, **18**, 585—594).—The partition coefficients were determined, in the case of solutions of iodine and bromine, in water and (1) carbon bisulphide, (2) bromoform, (3) carbon tetrachloride. In carbon bisulphide and water, a marked decrease of the partition ratio occurs with dilution, probably owing to the decomposition of complex molecules. A similar decrease occurs with bromoform, but with carbon tetrachloride the ratio remains almost constant. The numbers obtained with iodine for the carbon bisulphide: water ratio (685 to 600 at 18°) differ considerably from those obtained by Berthelot and Jungfleisch (400). In saturated solutions, the partition coefficient should be equal to the ratio of the solubilities in the two solvents, and the following table shows that this is the case, the numbers being obtained by extrapolation.

Water and	Solubility ratio.	Partition coefficient.
Carbon bisulphide..........	679·0	685·0
Bromoform	559·0	558·5
Carbon tetrachloride........	89·6	89·7

On the assumption that the change in the coefficient is due to the passage from double to single molecules, the concentration of the aqueous solution is calculated from that in the other solvent, the numbers agreeing well with the observed values. The departure from normality in the case of solutions of carbonic anhydride is also considered and referred to the formation of complexes at the higher concentrations. L. M. J.

The Course of Chemical Reactions in Gases. By LUDWIG STORCH (*Zeit. physikal. Chem.*, 1896, **19**, 1—12).—According to the researches of van't Hoff, the reaction velocity for the formation of water from the mixed gases does not lead to a constant, if calculated for a trimolecular equation. The author, by applying the general differential equation $dC/dt = kC^n$, obtains a constant $k = 0·004725$ when $n = 9$, in the case of moist mixed gases. For the experiments with the dry explosive mixture, the value obtained is $k = 0·003091$; $n = 12$. It has also been shown that similar experiments with other gases do not lead to the reaction order expected, and the author explains these anomalies by the heat generated during the action. Thus, in the above case, at the temperature employed (boiling point of sulphur = 440°) the heat evolved per molecular equivalent is 111,345 units at constant volume, and 112,771 at constant pressure, so that the temperature of the water produced would be 3785° and 3108° respectively. At this temperature, however, the water molecules cannot exist, and in order that they may actually be formed, an excess of cooling molecules must be present. If 1500—2000° be taken as the temperature at which the water remains undissociated, the true equation hence becomes $(2H_2 + O_2 + 9·8\ M)_{440°} = (2H_2O + 9·8\ M)_{1500°}$, or $(2H_2 + O_2 + 4·7\ M)_{440°} = (2H_2O + 4·7\ M)_{2000°}$ at constant pressure, and similar equations occur with 12·9 M or 6·7 M at constant volume, so that the value for n should be between the limits 12·8—7·7 and 15·9—9·7 respectively. Similarly, the formation of hydrogen chloride should be abnormal, and the normal values of Bunsen and Roscoe are referred chiefly to the presence of the water, whilst the normal value of Bodenstein for the decomposition of hydrogen iodide, is owing to the fact that the thermal change accompanying it is very small (Abstr., 1893, ii, 369; 1894, ii, 12).

L. M. J.

Chemical Kinetics of Oxidation. I. Speed of Liberation of Iodine in Mixed Solutions of Potassium Chlorate, Potassium Iodide, and Hydrochloric acid. By HERMAN SCHLUNDT (*Amer. Chem. J.*, **17**, 754—770).—Mixed solutions of potassium iodide and chlorate were heated at 100°, in small sealed tubes, with hydrobromic, hydrochloric, nitric, or sulphuric acid, the liberated iodine being estimated by titration with sodium thiosulphate. The conclusions drawn from the results are: (1) The speed of the reaction increases with the temperature. (2) Equivalent excess of iodide or chlorate produces equal accelerations, excess of acid produces a more marked acceleration. (3) The speed increases with the concentration. (4) For complete and rapid reduction of the chlorate, excess both of iodide and acid must be present. (5) The four common mineral acids may be arranged in the order given above, in regard to their relative influence in accelerating the action; the order being identical with that assigned to them by Ostwald. A. L.

Chemical Kinetics of Oxidation. II. Mathematical Theory of Oxidation Processes. By ROBERT B. WARDER (*Amer. Chem. J.*, 1896, **18**, 23—43).—This paper is a review of the work which has been done in search of the mathematical law controlling the speed of oxidation of hydriodic acid in different systems, and has special reference to the preceding paper. A. G. B.

Mixer for accelerating Chemical Reactions. By WLADIMIR MARKOWNIKOFF (*Annalen*, 1895, **289**, 254—257).—The author describes a form of apparatus which finds application to all classes of liquids, and may be heated or cooled, as occasion requires. Essentially it consists of a tinned copper cylinder capable of rapid rotation on its axis, and provided with ribs or beaters parallel to the axis.

M. O. F.

Pressure Tube for Laboratory Experiments. By JOHANN WALTER (*J. pr. Chem.*, 1896, [2], **53**, 132—139).—The object of this tube is to render it possible to maintain an external pressure on the glass tube which is being heated equivalent to the internal pressure, a principle which has been applied by Ullmann (*Ber.*, **23**, 379). The steel tube is of Mannesman make, and is of 32 mm. diameter, and 560 mm. in length. The head piece is usually of bronze, in which case no washer is necessary, the flange being tightened by a screw working in a stirrup, made in a piece with a collar welded on to the tube. Two side necks in the head-piece, provided with appropriate valves, permit of connection with a cylinder of compressed carbonic anhydride, and a manometer. In this way it is possible to maintain a constant pressure within the steel tube. The author finds that, instead of the usual pressure tubing, it is possible to use soft glass tubing of 1·5—2 mm. thickness in the walls when external pressure is maintained in this way, except when corrosive liquids are being heated; indeed, it is frequently permissible to omit to seal the glass tube, a cork serving when the carbonic anhydride is to be excluded and the temperature will permit. Details of the application of the tube for determining the solubility of sparingly soluble gases in liquids, the solubility of substances at high temperatures under pressure, and the vapour pressure of liquids at high temperatures, are given, and two drawings accompany the paper. A. G. B.

Inorganic Chemistry.

Nitrogen Sulphide. By A. CLEVER and WILHELM MUTHMANN (*Ber.*, 1896, **29**, 340—343).—Nitrogen sulphide, N_4S_4, obtained by the action of ammonia on sulphur dichloride, yields bronze-coloured crystals of a compound, $N_4S_4Br_4$, when treated with bromine in carbon bisulphide solution; this decomposes in moist air, forming a yellow, amorphous compound, $N_4S_5Br_2$, or perhaps N_4S_4,SBr_2. Nitrogen sulphide also absorbs bromine vapour, forming red crystals of the composition $N_4S_4Br_6$; this compound is very unstable; carbon bisulphide deprives it of some bromine, and it decomposes in moist air, yielding the compound $N_4S_5Br_2$. With nitric peroxide in carbon bisulphide solution, it yields crystals of a compound, NSO_4, which is decomposed by water into nitric oxide and sulphuric acid. If the compound $N_4S_4Br_4$ is digested with nitric peroxide in carbon bisulphide solution, yellow crystals are formed, probably of the composition NSO; these are very unstable, the heat of the hand being sufficient to decompose them. With nitric peroxide, the substance $N_4S_5Br_2$ forms large, yellow crystals of a compound, $N_4S_3O_6$. C. F. B.

Origin of the Argon and Helium in the Gas from Sulphuretted Waters. By LOUIS J. TROOST and LÉON V. R. OUVRARD (*Compt. rend.*, 1895, **121**, 798—799; and by BOUCHARD, *ibid.*, 800).—The gases extracted from the water of the Seine, and from sea water, contain argon, but only very feeble, and often uncertain, traces of helium. The gases from the sulphuretted waters of Cauterets, on the other hand, contain helium in distinct and readily recognisable quantities. The authors are of opinion that the helium is not derived from the atmosphere, but from minerals, such as cleveite, bruggerite, monazite, &c., in the rocks through which the waters percolate.

BOUCHARD considers that although it may not be possible to attribute any special therapeutic action to the argon and helium present in the waters referred to, it is quite conceivable that compounds of them may be dissolved in the waters, and exert an important influence on their therapeutic effects. C. H. B.

Argon and Helium in a Mineral Water. By CHARLES MOUREU (*Compt. rend.*, 1895, **121**, 819—820).—Water from the spring at Maizières (Côte d'Or), which contains lithium compounds and very little calcium sulphate, was collected in such a way as to avoid contact with air, and the gas extracted from it was found to contain both argon and helium. The residue not absorbed by lithium at a dull red heat amounts to as much as from one-fifteenth to one-tenth of the total volume of the gas. C. H. B.

Separation of Atmospheric Argon and Nitrogen. By CLAUDIUS LIMB (*Compt. rend.*, 1895, **121**, 887—888).—When barium fluoride or barium sodium fluoride (both of which can be obtained cheaply) is heated at a moderate temperature with sodium in an iron tube, a grey product is obtained, which consists chiefly of barium, and rapidly absorbs nitrogen. This process may probably be used for the separation of nitrogen from argon, although it is not yet definitely established that the latter is not absorbed by the barium. C. H. B.

Combination of Nitrogen with Metals of the Alkaline Earths. By LÉON MAQUENNE (*Compt. rend.*, 1895, **121**, 1147—1148).—The author found some time ago that metals of the alkaline earths combine readily with nitrogen (Abstr., 1892, 566 and 776), and this fact can be utilised for the isolation of argon, since either calcium or barium is readily obtained from its oxide by the action of magnesium. The most satisfactory results are obtained by means of a mixture of magnesium powder and pure and well dried calcium oxide heated at dull redness. C. H. B.

Combination of Nitrogen with Metals. By A. ROSSEL (*Compt. rend.*, 1895, **121**, 941—943).—When powdered calcium carbide is mixed with magnesium powder and heated to dull redness in a crucible exposed to air, or in a tube through which air is passed, carbonic anhydride is liberated, and a mixture of calcium oxide and magnesium nitride is left. Aluminium, zinc, iron, and even copper, under similar conditions, yield similar products, which are decomposed by water with evolution of ammonia. C. H. B.

Absorption of Nitrogen by Lithium at the Ordinary Temperature. By HENRI DESLANDRES (*Compt. rend.*, 1895, **121**, 886—887).—When lithium prepared by the Guntz method of electrolysis is heated in a vacuum, at a temperature a little below the softening point of glass, it gives off a notable quantity of hydrogen. The bright metal, when left in contact with nitrogen at the ordinary temperature, gradually and completely absorbs it, just in the same manner that phosphorus absorbs oxygen. The black film which forms on the surface of freshly cut lithium when exposed to the air, seems to prevent the absorption of the nitrogen, and in order to secure rapid and complete absorption, the bright surface of the lithium must be renewed from time to time. C. H. B.

Lithium Subchloride. By ANTOINE GUNTZ (*Compt. rend.*, 1895, **121**, 945—947).—Lithium dissolves readily in fused lithium chloride, with formation of a new compound. If 27·4 grams of lithium chloride is heated to redness with 4·7 grams of lithium in a current of hydrogen, lithium subchloride, Li_2Cl, is obtained as a hard, greyish, homogeneous product, which decomposes water as readily as lithium does. $Li_2Cl + H_2O = LiCl + LiOH + H$. As a rule, the subchloride contains some nitrogen, but it seems to be free from the dark-coloured lithium nitride.

The author confirms the statements of previous observers as to the readiness with which lithium combines with nitrogen on heating, and he finds that even when the air is not quite dry, a considerable quantity of nitride is formed at the ordinary temperature.

C. H. B.

Influence of Time on the Welding of Pressed Chalk. By Walthère Spring (*Zeit. anorg. Chem.*, 1896, **11**, 160—164).—The author has examined a cylinder of white, dry chalk which has been compressed in a steel press at 6000—7000 atmospheres for 17 years. The surface of the chalk cylinder, to a depth of 1—1½ mm., was coloured yellow, owing to the diffusion of an iron compound, but the middle portion was quite white. It showed a conchoidal fracture similar to the fracture of lithographic stone; the middle portion was easily scratched with a needle, but the outside layer was very nearly as hard as marble, and gave indications of a crystalline structure.

This result shows that time has great influence on the welding of particles of a solid body when submitted to a pressure capable of bringing their surfaces into contact, and explains why the oldest rocks are generally the hardest and most solid. E. C. R.

Action of Lead and of Potassium Nitrite on Lead Nitrate. By Franz Peters (*Zeit. anorg. Chem.*, 1896, **11**, 116—159).—By the action of lead on an aqueous solution of lead nitrate, a basic lead nitrate, PbN_2O_6,PbO_2H_2, is first formed. When the ratio of lead to lead nitrate employed reaches 1 : 2 or 1 : x where x is less than 2, isomorphous mixtures of basic lead nitrate with basic lead nitratonitrite, $PbN_2O_6,PbN_2O_4,2PbO_2H_2$, are obtained. The latter is obtained alone when the ratio of lead to lead nitrate is 7 : 8 or 1 : 1. With gradually increasing proportions of lead, isomorphous mixtures of basic lead nitratonitrite with basic lead nitrite are obtained. With 1 of lead nitrate to 1½ of lead, a dibasic lead nitratonitrite is formed. When the ratio of the lead is increased to 1¾ atoms, isomorphous mixtures of dibasic nitratonitrite with the tribasic nitrite,

$$PbN_2O_4,PbO_2H_2,2PbO,$$

are obtained; the latter alone is formed by the prolonged action of lead on a solution of lead nitrate. When 1¾ to 2⅕ atoms of lead are employed to 1 vol. of lead nitrate, at first an isomorphous mixture of tribasic and monobasic nitrite is formed, and then dibasic nitrite, and from this an isomorphous mixture of the last salt with the tribasic nitrite. Lead oxide can be employed in place of lead in order to convert one of the salts of this series into another containing a larger proportion of lead oxide.

When a solution of potassium nitrite is allowed to act on a boiling solution of lead nitrate, a basic lead nitrate is at first formed as is the case when the lead nitrate is treated with metallic lead. It is obtained by employing the reagents in the ratio $PbN_2O_6 : KNO_2 = 1 : 1$ to 3 : 4. When the ratio reaches 2 : 3 or 1 : 2 basic lead nitratonitrite, $PbN_2O_6,PbN_2O_4,2PbO_2H_2,2H_2O$ is formed. By increasing the proportion of potassium nitrite, the compounds described above are obtained. As the action of potassium nitrite on lead nitrate is similar to that of lead, so also it converts the first members of the series of compounds obtained by the action of lead into the following members of the series. E. C. R.

Action of Alcohol on Mercurous Iodide. By MAURICE FRANÇOIS (*Compt. rend.*, 1895, **121**, 888—891).—Although alcohol is commonly employed in the preparation of mercurous iodide, it is not without action on it, especially when heated. Boiling alcohol decomposes the iodide into mercuric iodide and mercury, the action being limited and reversible, and the decomposition ceasing when the boiling alcohol of 95° contains 0·222 gram of mercuric iodide in 100 grams of the liquid. With a higher proportion, the solution acts on mercury and converts it into mercurous iodide until the limit is reached. 1000 grams of boiling alcohol of 95° will decompose about 3·15 grams of mercurous iodide; the alcohol commonly employed for washing mercurous iodide gradually decomposes it, removing mercuric iodide and leaving mercury; and the two iodides cannot be accurately separated by means of alcohol. C. H. B.

Presence of Sodium in Aluminium prepared by Electrolysis. By HENRI MOISSAN (*Compt. rend.*, 1895, **121**, 794—798).—Many specimens of aluminium, prepared by electrolysis, contain small quantities of sodium, the presence of which can sometimes be made evident by allowing the metal to remain for a long time in contact with water, especially if the liquid is boiled from time to time. In the specimens examined, the proportion of sodium varied from 0·1 to 0·3 per cent. An old specimen contained 0·42 per cent. When sodium is present, the aluminium is attacked by cold water, and if the water is not changed, the action increases in rapidity owing to the formation of sodium aluminate, which is dissociated by the water with continual regeneration of sodium hydroxide. Small quantities of sodium will also have an important influence on the properties of alloys of aluminium with other metals. Riche found that an alloy of aluminium and tin is attacked by cold water, and the author confirms this statement, even when the aluminium is free from sodium.

Many alloys of aluminium with other metals are attacked by water or saline solutions, and the chief reason seems to be that as a rule they are not homogeneous, and small galvanic circuits are formed at the surface of the metal. On the other hand, if the metal is homogeneous and is free from nitrogen, carbon, and sodium, it is not affected by water. The great tendency that aluminium shows to form galvanic couples with other metals indicates that, for constructive purposes, it should always be used alone in as pure a form as possible, and not alloyed with another metal, nor should it be in contact with other metals. C. H. B.

Combination of Anhydrous Ammonia and Aluminium Chloride. By JOHN M. STILLMAN and MINNIE B. YODER (*Amer. Chem. J.*, 1895, **17**, 748—753).—Carefully dried ammonia, at first mixed with air in order to mitigate the violence of the action, is passed over cooled, anhydrous aluminium chloride. The *product*, $AlCl_3,6NH_3$, is a bulky, white powder with a powerful odour of ammonia. It is decomposed by water, with production of aluminium hydroxide.

When heated in a current of dry air, it undergoes oxidation, a *compound* of alumina and ammonium-chloride being formed. The former substance, when heated in dry hydrogen, yields a hygroscopic *compound*, $AlCl_3,2NH_3$. These results are similar to those obtained in the case of ferric chloride.

The compound, $AlCl_3,3NH_3$, described by Rose and by Persoz (see Graham Otto, 5 *Auf.*, **4**, 2, 31), was not obtained. A. L.

Action of Ferric Salts on Iodides in Aqueous Solution. By FRIEDRICH W. KÜSTER (*Zeit. anorg. Chem.*, 1896, **11**, 165—174).—A theoretical paper in which the author discusses the results obtained by Seubert (Abstr., 1895, ii, 17, 111, and 395). These results are in accordance with Arrhenius's theory and its consequences.

E. C. R.

Silicides of Iron. By GUILLAME DE CHALMOT (*J. Amer. Chem. Soc.*, 1895, **17**, 923—924).—By heating a mixture of iron filings, sand, and charcoal in an electric furnace, the author obtained a silicide containing 23—27 per cent. of silicon. Occasionally it forms crystals about 1 cm. long of a pure ferric silicide of the formula Fe_3Si_2. It is white and crystalline, of sp. gr. = 6·36, hard, brittle, and only slightly magnetic, but is a good conductor of electricity. It is fairly proof against oxidising acids, but is slowly attacked by cold nitro-hydrochloric acid (1 : 3), which, however, chiefly dissolves the iron, but scarcely any silicon. Fusion with potassium nitrate and potassium sodium carbonate, or treatment with hydrofluoric acid soon breaks up the compound.

The author also obtained a compound approaching the formula $FeSi_2$, which had a sp. gr. of 4·851, was non-magnetic, and was scarcely acted on by aqua regia. L. DE K.

Atomic Weight of Cobalt. By WALTHER HEMPEL and HERMANN THIELE (*Zeit. anorg. Chem.*, 1896, **11**, 73—105).—The authors have re-examined the methods of determining the atomic weight of cobalt employed by Remmler (Abstr., 1893, ii, 211) and C. Winkler (Abstr., 1893, ii, 469).

The material employed was prepared by fractionally precipitating 3 kilos. of cobalt chloride with a solution of potassium hydroxide; 22 fractions were obtained. The results obtained with separate fractions, according to Remmler's method, show that the experimental errors are much greater than the difference in the atomic weight.

Method by Reduction of the Oxide Co_3O_4.—The pure material was prepared as follows: Each fraction was treated (1) with hydrogen sulphide; (2) twice precipitated with potassium nitrite to separate it from nickel; (3) precipitated with ammonia to remove alumina, ferric oxide, and silica; (4) twice precipitated with ammonium sulphide, and washed with hydrochloric acid to remove alkali and traces of iron and zinc, the oxide obtained by roasting the sulphide was then reduced, washed with water, dissolved in nitric acid, and the nitrate cautiously decomposed by heating in a platinum basin. The oxide thus obtained is heated to a constant weight in a current of carbonic anhydride or nitrogen, and then reduced in a current of hydrogen. The mean of three experiments gave the atomic weight Co = 58·848.

A second and third series of determinations were made according to Winkler's method by taking a known weight of metal, converting it into chloride, and precipitating with silver nitrate, the weight of cobalt chloride and of silver chloride being determined. A special apparatus, by which all errors due to dust, moisture, &c., were eliminated as nearly as possible, was employed, drawings of which are given in the original paper. A weighed quantity of the metal, purified by electrolytic decomposition, was dissolved in hydrochloric acid, evaporated to dryness, and heated in a current of hydrogen chloride at 195° until the weight became constant. After the hydrogen chloride had been removed by a current of carbonic anhydride while the apparatus was still hot, and then the carbonic anhydride by means of an air-pump, the cobalt chloride was weighed, and the chlorine estimated gravimetrically. The mean of six experiments in which the cobalt chloride was weighed gave Co = 58·64, and the mean of four experiments in which the silver chloride was weighed gave Co = 58·770. The mean values obtained, corrected to vacuum, were (1) by weighing the oxide and metal, Co = 58·826, (2) by weighing the metal and chloride, Co = 58·61, (3) by weighing the metal and silver chloride, Co = 58·765; when O = 15·96, Cl = 35·37, and Ag = 107·66. The last value is probably the most accurate. E. C. R.

Action of Hypochlorous acid on the Chlorides of Cobalt and Manganese. By Euthyme Klimenko and Boris Klimenko (*Ber.*, 1896, **29**, 478—481).—The authors have estimated the amount of the oxides of manganese and cobalt which are precipitated when solutions of the corresponding chlorides and of hypochlorous acid are mixed. Their results show that the maximum amount of manganese peroxide is precipitated when the ratio of the amounts of the two reagents is that theoretically required for the production of MnO_2. In the case of the cobalt compound, the relative amount of the sesquioxide produced does not appear to be materially diminished when the relative amount of hypochlorous acid is diminished to one-third of that theoretically required for the production of Co_2O_3. A. H.

Chromium Amalgam and some Properties of Chromium. By Jules Férée (*Compt. rend.*, 1895, **121**, 822—824).—Experiments previously made by the action of sodium amalgam on haloïd chromium salts, or by the electrolysis of chromium salts in presence of mercury, have yielded amalgams containing only a very small proportion of chromium. The author finds that better results are obtained by electrolysing a solution containing 160 grams of chromic chloride and 100 grams of concentrated hydrochloric acid in 740 grams of water by means of a powerful current with a mercury cathode and a platinum anode. Using a current of 22 ampères and a mercury surface of 8·05 sq.c. he obtained 1·5 kilo. of a solid chromium amalgam; when dried and filtered through chamois leather, the amalgam has the composition Hg_3Cr. When this is subjected to a pressure of 200 kilos. per sq.c., it loses mercury and yields another amalgam of the composition HgCr. The first amalgam is soft, brilliant, and alters but little in air, but when heated loses mercury without melting and oxidises rapidly; the second is brilliant and harder, but alters more readily. When distilled in a vacuum below 300°, they both yield chromium which is pyrophoric at ordinary temperatures, and combines with both oxygen and nitrogen, the whole mass being raised to a bright red heat. At the ordinary temperature, it absorbs nitric oxide with incandescence and the production of a mixture of chromium nitride and oxide, and it also absorbs nitrogen, becoming incandescent and forming chromium nitride. When heated more strongly in a vacuum, the pyrophoric chromium loses its activity.

C. H. B.

Crystallised Chromous Sulphide. By A. MOURLOT (*Compt. rend.*, 1895, **121**, 943—945).—Chromous sulphide, CrS, is obtained by passing hydrogen sulphide over chromium, heated at the highest temperature of a coke reverberatory furnace, or in the electric tube furnace. In the latter, it fuses, and, when cooled, has a crystalline structure, and contains cavities lined with prismatic needles which scratch quartz easily. Its sp. gr. is 4·08. Fluorine attacks it at incipient redness, chlorine at about 340°, bromine at a higher temperature, and iodine not at all. It burns readily in oxygen, and is attacked by hydrogen fluoride in the cold, but by hydrogen chloride only at a bright red heat. Concentrated acids attack it either in the cold or on heating gently, and this is true of potassium chlorate or nitrate and lead peroxide. Fused alkali carbonates oxidise the sulphide. Hydrogen does not attack chromous sulphide at 1200°, but carbon reduces it in the electric furnace. C. H. B.

Titanium Silicide and Crystallised Titanium. By LUCIEN LÉVY (*Compt. rend.*, 1895, **121**, 1148—1150).—The action of titanium chloride on silicon at a high temperature yields arborescent crystals, the composition of which corresponds with the formula Ti_2Si. Whether they are identical with the crystals previously described (Abstr., 1890, 1066) is not yet ascertained. There is reason to believe that in many cases the crystalline products of the action of titanium chloride on metals, silicon, &c., contain crystals of titanium.

C. H. B.

Alums of Vanadium Trioxide. By AUGUSTO PICCINI (*Zeit. anorg. Chem.*, 1896, **11**, 106—115).—*Ammonium vanadium alum*, $NH_4V(SO_4)_2 + 12H_2O$, is obtained by treating ammonium metavanadate mixed with sulphuric acid with a saturated solution of sulphurous anhydride until all the salt is dissolved. The solution is heated on the water-bath until the sulphurous anhydride is eliminated, and then reduced by means of an electric current. It crystallises in pentagonal hemihedral forms belonging to the cubic system, and is violet. It is very easily soluble in water, and the crystals, on exposure to air, become gradually covered with a pale green skin. At 50°, it melts in its water of crystallisation to a green liquid, which then solidifies to a green mass, changing to violet; at 230°, it is converted into an anhydrous, yellowish-green mass, which is not completely soluble in water, but gradually dissolves on exposure to air forming a blue solution. When heated above 300°, it is decomposed, with formation of vanadic anhydride.

The author was unable to prepare a vanadium alum with hydroxylamine sulphate. By working in a similar manner to the above, a small quantity of the ammonium salt was obtained. The vanadium trioxide is oxidised by hydroxylamine, according to the equation $V_2O_3 + NH_3O = V_2O_4 + NH_3$. The sesquioxides of titanium and molybdenum are also converted into the dioxides when treated with hydroxylamine.

Rubidium vanadium alum, $RbV(SO_4)_2 + 12H_2O$, is obtained in a similar manner to the ammonium salt. It crystallises in transparent, bluish-violet, hemihedral forms belonging to the cubic system, and is much less soluble than the ammonium salt. It gradually gives up its water at 100°, and turns yellowish-green, is anhydrous at 230°, and is then no longer soluble in water; when heated above 300°, it is decomposed.

Cæsium vanadium alum, obtained in a similar manner, crystallises in ruby-red to amethyst-violet cubical crystals, and is very sparingly soluble in cold water, but much more readily in hot water. The crystals are only slightly altered by exposure to air, gradually give up water at 100°, are anhydrous at 230°, and then turn green, and are decomposed when heated above 300°. E. C. R.

Existence of Sulphoxyantimonates. By LEROY W. MCCAY (*Amer. Chem. J.*, **17**, 770—778).—The salt obtained by Rammelsberg (*Ann. Phys. Chem.*, 1841) by the action of potassium hydroxide on antimony pentasulphide, is not a double salt, but a secondary potassium orthosulphoxyantimonate, $K_2HSbO_2S_2 + 2H_2O$. It is prepared by allowing a cold solution of potassium hydroxide to act on antimony pentasulphide during 24 hours. It crystallises in radiating clusters of needles, which in moist air assume a red or crimson colour, without deliquescing. At 150°, it loses $2H_2O$, a temperature of 250° being necessary to expel the combined water. Aqueous solutions of the salt give, with metals of the alkaline earths, white precipitates which become crystalline; with silver salts, a black precipitate; and with copper and lead salts, red precipitates which gradually turn black. Hydrochloric acid decomposes the salt with formation of antimony tri-, and penta-sulphides, tri- and pent-oxides, and sulphur.

A. L.

Derivatives of Niobium and Tantalum. By MARY E. PENNINGTON (*J. Amer. Chem. Soc.*, 1896, **18**, 38—67).—The decomposition of columbite when fused with potassium acid sulphate is not quite so rapid or complete as by the method proposed by Gibbs, who decomposes the mineral by fusing with potassium hydrogen fluoride. When the double fluorides thus obtained are submitted to the action of the electric current, a lower hydrated oxide of niobium and tantalum is incompletely precipitated. The hope of discovering a better method for the separation of niobium, tantalum, and titanium by the difference in the solubility of their double fluorides with rubidium and cæsium has not been realised. The heating of the oxides of niobium and tantalum in sealed and vacuous tubes with phosphorus pentachloride yields their pentachlorides and phosphorus oxychloride.

The authoress communicates a delicate reaction for niobium, applicable to any soluble compound. An excess of potassium thiocyanate is added to the dissolved substance, and then some pieces of zinc, followed by strong hydrochloric acid. The solution becomes at once a bright golden-brown, or, if much niobium is present, almost red; the colour is stable for about 24 hours, and is not altered by a brisk and continuous evolution of the gas; tantalum and titanium do not give this reaction. Admixture of titanium may be proved by the following test. A few c.c. of strong sulphurous acid is treated in a test tube with a few pieces of zinc; as soon as evolution of gas ceases, the liquid is added to the solution to be tested; a solution containing titanium at once gives an orange-yellow coloration; columbium or tantalum yields, after some time, a white precipitate. Many other tests are given. L. DE K.

Mixed Haloïd Compounds of Platinum and Potassium. By CHARLES H. HERTY (*Ber.*, 1896, **29**, 411—414).—The series of compounds, $K_2PtCl_nBr_{6-n}$ (n less than 5), prepared by Pitkin (*J. Amer. Chem. Soc.*, **1**, 472; **2**, 196), is shown to consist of isomorphous mixtures, in different proportions, of the two salts, K_2PtCl_6 and K_2PtBr_6. C. F. B.

Mineralogical Chemistry.

Phosphorescent Diamonds. By GEORGE F. KUNZ (*Trans. New York Acad. Sci.*, 1895, **14**, 260).—The various colours of diamonds are attributed to the presence of hydrocarbons, and the phosphorescence and fluorescence of certain diamonds are attributed to a bluish-white substance, which is undoubtedly a hydrocarbon, and for which the name *tiffanyite* is proposed. L. J. S.

Artificial Formation of Magnetic Pyrites [Pyrrhotite]. By L. BUCCA (*Zeit. Kryst. Min.*, 1895, **25**, 398; from *Rivista Min. Crist.*, 1893, **13**, 10).—A luting, consisting of a mixture of sulphur, iron filings, and ammonium chloride, used for mending broken retorts in the sulphur industry in Catania, Sicily, was found, after having been heated for several months, to consist essentially of FeS. In cavities in this mass were tabular crystals of hexagonal outline; these had the sp. gr. 4·545, and contained 41·4 per cent. of sulphur, corresponding with the formula Fe_4S_5. It is supposed that pyrrhotite may be represented by the formula nFeS + Fe_3S_4, and the strong magnetic character of the present crystals is supposed to be due to the near approach of Fe_4S_5 to Fe_3S_4. L. J. S.

Plumboferrite from Sjö Mine, Sweden. By LARS J. IGELSTRÖM (*Jahrb. f. Min.*, 1896, i, Ref. 15; from *Geol. För. Förh.*, 1894, **16**, 594).—Plumboferrite, before only known from Jakobsberg, Sweden, has been found at the Sjö mine, Örebro, as hexagonal plates having the appearance of molybdenite; streak, pale red. After deducting much admixed barytes, and calculating the FeO in agreement with the formula $(Pb,Fe,Cu)O,Fe_2O_3$, the analysis is given as

Fe_2O_3.	PbO.	FeO.	CuO.	Total.
54·67	32·60	9·21	3·52	100·00

L. J. S.

New Method of producing Artificial Oligiste [Hæmatite]. By HENRYK ARCTOWSKI (*Bull. Acad. Belg.*, 1894, [3], **27**, 933—936).—On passing a rapid current of ammonium chloride vapour over ferric oxide heated at about 700°, small crystals of hæmatite are formed. This is a modification of previous methods; hydrogen chloride being supplied by the dissociation of the ammonium chloride, the water vapour and ferric chloride thus formed reacting to form crystallised hæmatite. At lower temperatures, the ammonium chloride is absorbed by the ferric oxide, and ferric chloride alone formed. Fine, unmodified cubes of ammonium chloride are deposited with the hæmatite. As ammonium chloride is found in volcanic fumaroles, it is suggested that it may have aided in this way in the formation of hæmatite. L. J. S.

Artificial Cassiterite. By ANDREAS ARZRUNI (*Zeit. Kryst. Min.*, 1895, **25**, 467—470).—Cassiterite, formed by the oxidation of tin vapour, or by the deposition of tin oxide from molten tin, occurs in druses in a refractory furnace material. The distorted, prismatic crystals, which measure up to 1 cm. by ½ cm., are brown or light violet in colour, the latter being transparent, and dichroic; there are no twin crystals. Measurements of the crystal angles, and of the indices of refraction are given.

	Li.	Na.	Tl.
ω........	1·9846	1·9968	2·0093
ε........	2·0817	2·0929	2·1053

With these crystals, there is a red-brown or green, granular tin dioxide; and also tin dioxide in the form of long, delicate, colourless needles, giving optical extinction angles of 0—19°, and being apparently monosymmetric. L. J. S.

Nickel Ore [Gersdorffite] from the Upper Harz. By FRIEDRICH KLOCKMANN (*Jahrb. f. Min.*, 1896, i, Ref. 63; from *Zeit. prakt. Geol.*, 1893, **1**, 385).—In the Gross-Schleifsteinthal, south of Goslar, there has recently been found a lode of nickel ore, consisting principally of gersdorffite, with also pyrites and calcite. Analyses by G. Bodländer gave I for the crystals, and II for the massive ore.

	Ni.	Co.	Fe.	As.	Sb.	S.	Insol.	Total.
I.	32·65	1·00	0·60	45·20	1·96	17·75	0·95	100·11
II.	30·15	1·34	0·84	43·87	1·55	16·09	5·61	99·45

L. J. S.

Rhodophosphite and Tetragophosphite, two new Minerals from Horrsjöberg, Wermland. By LARS J. IGELSTRÖM (*Zeit. Kryst. Min.*, 1895, **25**, 433—436).—*Rhodophosphite* occurs as white to pale red, hexagonal prisms, translucent to opaque, along with lazulite, kyanite, damourite, ilmenite, svanbergite, manganiferous garnet, &c., in quartzite, at Horrsjöberg, Wermland, Sweden. Analyses gave

P_2O_5.	CaO.	MnO + FeO.	Cl.	SO_3.	F.	Total.
36·42	45·17	8·80	2·92	1·34	not estim.	97·93

Considering the difference as fluorine, the formula is deduced as $20(RO)_3P_2O_5 + 4(CaCl_2,CaF_2) + CaO,SO_3$. In containing sulphuric acid, which seems to be always present in constant amount, the mineral resembles svanbergite, and differs from apatite, with the latter of which it is sometimes intergrown.

Tetragophosphite occurs at the same locality with rhodophosphite, as transparent, four-sided blue plates; it is not attacked by acids; analyses gave

P_2O_5.	Al_2O_3.	FeO + MnO.	MgO + CaO.	H_2O.	Total.
36·92	40·00	9·51	7·50	5·96	100·00
33·64	41·81	9·51	6·74	8·30	100·00

Formula, $(RO)_3P_2O_5 + (Al_2O_3)P_2O_5 + 3H_2O$; this is slightly more basic than lazulite; it is near to the "light blue phosphate" of Blomstrand (1868), from Westanå, Skåne, Sweden, where similar phosphates to those of Horrsjöberg occur. L. J. S.

[Columbite from Wakefield, New Hampshire.] By MARY ENGLE PENNINGTON (*J. Amer. Chem. Soc.*, 1896, **18**, 39—45).—Occurs in large, black, lustreless masses; sp. gr. = 5·662 at 4°. Small, bright yellow patches of uraconite are scattered over the surface. Analysis gave

Ta_2O_5, Nb_2O_5, TiO_2.	WO_3, SnO_2.	U_3O_8.	Fe_2O_3.	FeO.	CaO.	MnO.	H_2O.	Total.
78·04	0·24	0·48	5·22	6·42	0·02	8·96	1·22	100·6

A. J. G.

Inesite from Jakobsberg, Sweden. By AXEL HAMBERG (*Jahrb. f. Min.*, 1896, i, Ref. 20; from *Geol. För. Förh.*, 1894, **16**, 304).—Rose-coloured inesite has been found with kentrolite and calcite in a granular limestone at Jakobsberg, Nordmark. The triclinic crystals are tabular parallel to (100), and show the cleavages (010) perfect, (100) distinct, $(1\bar{1}0)$ imperfect. Analysis gave

SiO_2.	PbO.	MnO.	MgO.	CaO.	H_2O (over H_2SO_4).	H_2O (on ignition).	Total.
42·92	0·73	36·31	0·37	8·68	0·62	9·86	99·49

The fine powder absorbed 2·7 per cent. of water in a damp atmosphere, but this was again lost (with 0·62 per cent. in addition) in the desiccator. After being dried over sulphuric acid, there is a loss of 1·09 per cent. H_2O at 53°, of 2·14 per cent. at 100°, and of 4·39 per cent. at 200°. The formula is given as $(Mn,Ca)H_2SiO_4$ or $(Mn,Ca)SiO_3 + H_2O$; this, however, requires 12·5 per cent. of H_2O. L. J. S.

Forsterite from Monte Somma. By ANDREAS ARZRUNI (*Zeit. Kryst. Min.*, 1895, **25**, 471—476).—Measurements of the crystal angles and of the optic axial angles are given for colourless, transparent crystals of forsterite from the bombs of Mte. Somma.

$$a : b : c = 0{\cdot}46663 : 1 : 0{\cdot}58677 \text{ (S. Jolles).}$$

The crystals are thick, tabular parallel to $b(010)$, and are sometimes twinned on both $h(011)$ and (031). Analyses by K. Thaddéeff on two samples gave

	SiO_2.	MgO.	FeO.	CaO.	Al_2O_3.	Total.	Sp. gr.
I.	42·65	56·57	1·35	0·29	—	100·86	3·223
II.	42·39	55·09	3·12	—	0·23	100·83	3·245

Deducting lime from I as belonging to calcite or wollastonite, and alumina and the corresponding amount of monoxides to form pleonaste from II, these analyses reduce very closely to $2RO,SiO_2$.

L. J. S.

Guarinite. By ORAZIO REBUFFAT (*Jahrb. f. Min.*, 1896, i, Ref. 28; from *Lab. chim. R. scuola di app. gl'ingegneri, Napoli*, 1894, 1—10).—From the incomplete analysis previously made of this Vesuvian mineral, it has been considered to be a titano-silicate of calcium; the following analysis is now given.

SiO_2.	Y_2O_3?	Ce_2O_3.	Fe_2O_3.	Al_2O_3 (diff.).	CaO.	Na_2O.	K_2O.	Total.
34·84	1·23	3·45	1·69	25·37	25·20	6·57	1·56	99·91

This gives the formula $10SiO_2,5(Al,Fe,Ce)_2O_3,8CaO,2(Na,K)_2O$. This is the first Vesuvian mineral in which cerium has been found.

L. J. S.

Caswellite, an altered Biotite from Franklin Furnace, N.J. By ALBERT H. CHESTER (*Trans. New York Acad. Sci.*, 1894, **13**, 181—183).—This new mineral, from Trotter mine, Franklin Furnace, N. J., which has the characters of a clintonite, is flesh-red to light copper-red; it has a bronzy lustre, a micaceous structure, and is brittle; H = 2·5—3; sp. gr. = 3·54. It is associated with massive, yellow garnet (polyadelphite), rhodonite, and somewhat altered, dark brown biotite, into the latter of which there is a gradual passage. It is completely decomposed by hydrochloric acid, with separation of gelatinous silica; the mean of two analyses is

Loss on ignition.	SiO_2.	Fe_2O_3.	Al_2O_3.	Mn_2O_3.	CaO.	MgO.	Total.
4·64	38·74	6·85	6·58	15·95	22·30	2·52	100·58

This gives approximately the ratio $SiO_2 : R_2O_3 : RO : H_2O = 6 : 2 : 5 : 2{\cdot}5$. The mineral is very feebly doubly refracting, has no pleochroism, and has a larger optic axial angle than the biotite from which it has been derived. Unaltered biotite from another part of the mine contains a considerable amount of potassium, much magnesium, and little or no calcium, and it is supposed that the caswellite has been derived by the local action of water containing manganese and calcium on this biotite, the alkalis having been carried away.

L. J. S.

Andalusite and Spessartite from Bodenmais, Bavaria. By Ernst Weinschenk (*Zeit. Kryst. Min.*, 1895, **25**, 357—364).—*Andalusite.*—This occurs as unaltered, prismatic crystals in the pyrrhotite deposits of Silberberg, near Bodenmais, together with quartz, orthoclase, biotite, cordierite, &c. When enclosed in the quartz, it is clear and transparent, greenish to reddish in colour, and strongly pleochroic; but when embedded in the pyrrhotite, it is dark in colour, owing to enclosures of this mineral.

Spessartite.—This garnet lines fissures in a cordierite-gneiss at the same locality; dodecahedral crystals rest on a layer of the massive mineral, and the remainder of the fissure is filled up with pyrrhotite, pyrites, and blende. Analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	Total.
34·65	20·00	2·55	9·17	33·87	trace	100·24

The FeO is calculated by means of the garnet formula from 12·72 per cent. Fe_2O_3, which represents the total iron. A section shows a regular division into optically biaxial fields. The Aschaffenburg spessartite, of much the same composition, occurs as a primary constituent in granite, and differs in optical characters.

Tourmaline from Zwiesel and manganapatite from near Bodenmais are described, and cacoxenite is mentioned as an alteration product of the Rabenstein triphylite. L. J. S.

Crystalline form of Riebeckite. By William J. Sollas (*Proc. Roy. Irish Acad.*, 1895, [3], **3**, 516—523).—A micro-granite in the glacial deposits of the east coast of Ireland, and probably derived from Ailsa Craig, in the Firth of Clyde, contains, in drusy cavities, crystals of quartz, felspar, and riebeckite. The latter gave the crystallographic constants, $a : b : c = 0·54748 : 1 : 0·29246$; $\beta = 76° 10'$, which have not been before determined for this variety of hornblende. A partial analysis gave

SiO_2.	Al_2O_3, Fe_2O_3.	Na_2O.	K_2O.
42·69	41·71	10·00	0·87

L. J. S.

Jadeite from "Tibet." By Max Bauer (*Jahrb. f. Min.*, 1896, i, 85—95).—Amongst jadeite pebbles from "Tibet in N. Himalayas," four colour varieties are distinguished: (1) snow-white with a tinge of lilac or violet; (2) white with a tinge of grey; (3) white with a greenish tinge; (4) sombre green with blue and grey shades, the green colour being here due to iron and not to chromium, as in the emerald green spots of the white varieties. The last variety consists of interwoven needles and fibres, sp. gr. = 3·325, and contains veins and strings of white, compact, granular nepheline, which, on analysis by K. Busz, gave

SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.	Sp. gr.
42·47	35·92	1·02	14·57	4·27	2·39	100·64	2·628

With this is a small quantity of basic plagioclase, and enclosed in the nepheline grains are needles and prisms of jadeite. There is here, therefore, a jadeite-plagioclase-nepheline rock, in which nepheline plays the part of the ground-mass, and in which, locally, the relative amounts of the constituents vary very considerably, the larger green portion consisting mainly of jadeite, with here and there only a little felspar and nepheline. Two of the white varieties also show a little of this felspar and nepheline. Nepheline has previously only been recorded in igneous rocks, and its occurrence as a constituent of a crystalline schist is new. The low sp. gr. given for some jadeites (sometimes below 3, the normal being 3·3) is explained better by the presence of these minerals than by assuming uralitisation, for, if the whole of the pyroxene were changed to hornblende, the sp. gr. would still be greater than 3. This, together with isomorphous replacement, also explains the variations in chemical composition. L. J. S.

Jadeite from Mogoung, Burma. By Oliver C. Farrington (*Jahrb. f. Min.*, 1896, i, Ref. 19—20; from *Proc. U.S. National Museum*, 1894, **17**, 29—31).—Translucent, finely granular, white jadeite, from the Uru valley, gave the following result, which is the mean of two analyses on the white portion, the pale green spots being neglected.

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	MnO.	Na_2O.	Loss on. ignition.	Total.
59·22	24·55	0·34	0·18	trace	trace ?	14·46	1·14	99·89

This comes near to pure $Na_2O,Al_2O_3,4SiO_2$. When examined under the microscope, minute grains and fibres are seen, having the optical characters of pyroxene, and, in places, commencing alteration to hornblende. L. J. S.

Jadeite, Albite, and Glaucophane from Tammaw, Upper Burma. By Max Bauer (*Records Geol. Survey, India*, 1895, **28**, 91—105; and *Jahrb. f. Min.*, 1896, i, 18—51).—*Jadeite.*—This is snow-white with emerald-green spots, the latter containing chromium; sp. gr. varies from 3·338 to 3·325. Under the microscope, it is seen to consist of an aggregate of irregular pyroxene prisms. Analysis by K. Busz gave

SiO_2.	Al_2O_3.	CaO.	MgO.	Na_2O.	Loss on ignition.	Total.	Sp. gr.
58·46	25·75	0·63	0·34	13·93	1·00	100·11	3·332

Chromium and iron are absent. This corresponds with 90·1 per cent. of $Na_2O,Al_2O_3,4SiO_2$, 4·59 of $MgO,Al_2O_3,4SiO_2$, and 1·28 of CaO,SiO_2.

Albite.—Analysis by K. Busz of the snow-white ground-mass of an albite-hornblende rock gave

SiO_2.	Al_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Total.	Sp. gr.
64·60	19·92	trace	trace	1·02	14·01	99·55	2·587

This includes small quantities of augite, rhombic pyroxene, and an undetermined mineral.

Glaucophane.—This, as large, greyish crystals, forms the main part of an emerald-green glaucophane-schist; the green colour being due to crystals of bright green augite containing chromium; the augite enclosed in the glaucophane was not separated for the following analysis, by K. Busz; sp. gr. = 3·113—3·126.

SiO_2.	Al_2O_3, Cr_2O_3.	FeO.	CaO.	MgO.	Na_2O, K_2O.	Loss on ignition.	Total.
53·53	9·10	4·02	6·94	15·94	7·96	2·95	100·44

The large amount of soda in this amphibole points to glaucophane, although the optical characters are somewhat unusual. L. J. S.

Epidote from the Harz. By OTTO LÜDECKE (*Jahrb. f. Min.*, 1896, i, Ref. 30; from *Abhandl. Ges. Halle*, 1894, **20**, 311—325).—In cavities of a tourmaline granite on Ramberg are crystals of smoky quartz, epidote, tourmaline, fluorite, albite, orthoclase, zoisite, and apatite, of which crystallographic descriptions are given. The minerals are supposed to have originated in the decomposition of the granite to clay, as the latter fills the cavities. The epidote is almost colourless, with a tinge of yellow or green. Analysis gave

SiO_2.	FeO.	Fe_2O_3.	Al_2O_3.	CaO.	H_2O.	Total.	Sp. gr.
39·51	1·66	6·42	30·33	19·59	2·49	100·00	3·308

L. J. S.

Alteration of Garnet. By HEINRICH BARVIŘ (*Zeit. Kryst. Min.*, 1895, **25**, 431; from *Ber. böhm. Ges. Prag.*, 1894 (1893), No. XXVII). —In amphibolite pebbles from Hrubschitz, in Moravia, the garnets are surrounded by a zone of pale-green diopside, basic plagioclase, and fibrous hornblende, these having been produced, together with the separation of ilmenite, by the alteration of the garnet and the enclosed quartz. These alteration products are produced when garnet is fused. L. J. S.

The Garnet Group. By ERNST WEINSCHENK (*Zeit. Kryst. Min.*, 1895, **25**, 365—378).—Two sub-groups are distinguished. (1) Lime-garnets; (2) ferrous-, magnesia-, and manganous-garnets. The members of each of these groups show complete mixing amongst themselves, but there is only a slight mixing of the two groups, except sometimes in the case of lime- and manganous-garnets. The garnets which occur as primary constituents in igneous rocks are isotropic, whilst those of secondary origin in metamorphic rocks show optical anomalies; thus lime-garnets without titanium, and some manganous- and ferrous-garnets are optically anomalous, whilst titaniferous lime-garnets, most iron-garnets, and all magnesia-garnets are isotropic. The optical characters are related to the paragenesis, structure of the crystals, and the chemical composition.

L. J. S.

Beaumontite from Sweden. By NILS O. HOLST (*Zeit. Kryst. Min.*, 1895, **25**, 426; from *Sveriges Geol. Undersökning*, Ser. C, No. 110, 19). —Yellow crystals of beaumontite, coated with hydrated iron oxide, from drusy cavities in the rhyolite-breccia, near Mien Lake, in Blekinge, gave the following results on analysis by H. Santesson. The material was dried at 100°.

SiO_2.	Al_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
59·83	16·40	5·28	1·05	1·08	1·78	14·78	100·20

L. J. S.

Analysis of Emerald (?). By Orazio Rebuffat (*Jahrb. f. Min.*, 1896, i, Ref. 27; from *Lab. chim. R. scuola app. gl'ingegneri, Napoli*, 1894, 11—14).—A substance used in jewellery as emerald gave on analysis

SiO_2.	Al_2O_3.	FeO.	BeO.	X'.	X''.	CaO.	MgO.	Total.
49·91	28·66	2·25	7·34	0·49	7·66	1·96	1·60	99·87

This deviates considerably from the composition of emerald, as also does the sp. gr. of 3·139; and it is doubtful whether the material is an artificial product (perhaps by melting up smaller stones), or is an unknown mineral. L. J. S.

Amphibole [Hornblende] and Sodalite from the Trachyte of Montesanto, Naples. By P. Franco (*Zeit. Kryst. Min.*, 1895, **25**, 328—333).—*Hornblende:* delicate, needle-shaped, brown or black crystals from cavities in the trachyte of Montesanto (*Geol. Mag.*, 1889, [3], **6**, 74), show a development of the faces, which points either to hemihedrism of the monosymmetric system, or to the anorthic system, the latter with a close approach to monosymmetric angles. Analysis, on a small amount of material, gave

SiO_2.	Fe_2O_3.	Al_2O_3.	CaO.	MgO.	MnO.	Total.	Sp. gr.
40·79	27·40	7·01	11·54	10·60	0·90	98·24	3·06

Sodalite.—The crystals from the same trachyte are described; amongst them are groups consisting of four crystals twinned together, leaving a central hollow space. The material is colourless and transparent; isotropic, index of refraction for sodium light, 1·483; sp. gr. 2·198. Analysis gave

SiO_2.	Al_2O_3.	Na_2O.	CaO.	Cl.	Fe_2O_3.	MgO.	K_2O.	Total.
38·11	30·37	20·65	3·55	7·01	trace	—	—	99·69

L. J. S.

Knopite, a new Mineral near Perofskite, from Alnö, Sweden. By P. J. Holmquist (*Jahrb. f. Min.*, 1895, ii, Ref. 412—416; from *Geol. För. Förh.*, 1894, **16**, 73—95).—Minerals at first thought to be perofskite and dysanalyte are here described under the new name knopite, of which two types are distinguished.

Type I. This is found as lead-grey crystals of metallic lustre, about 5 mm. across, in crystalline limestone from Långarsholm, and is associated with garnet, titano-magnetite, dark green mica, and apatite; it also occurs in the serpentine-like masses enclosed in the limestone. The crystals are pseudocubic, and show dull octahedral faces, with smaller cube faces, which are bright and often conically rounded. By reflected light, a complicated lamellar structure, similar to that of perofskite, is seen. Very thin sections are translucent, and strongly doubly refracting, an eccentric optic axis being seen in places through a cube plane. Fresh crystals have H = 5—6, fracture uneven, and sp. gr. 3·8902; the sp. gr. of the purified powder being 4·1101. The mineral is decomposed by a mixture of hydrofluoric and sulphuric acids. Analysis gave

SiO_2.	TiO_2.	ZrO_2.	FeO.	MnO.	MgO.	Yt. earths (?).	Ce_2O_3.
1·29	58·74	0·91	3·23	0·31	0·19	0·06	5·80

CaO.	K_2O.	Na_2O.	H_2O.	Total.
26·84	0·75	0·29	1·00	99·41

This reduces to RO,TiO_2; ZrO_2 replacing TiO_2, whilst the silica is considered as an impurity.

Type II. This occurs in the Långarsholm limestone, and also in a breccia, from the margin of the nepheline-syenite at Norrvik, which consists mainly of serpentine-like masses with apatite, nepheline, and some calcite. The small black cubes of knopite have a metallic lustre; interpenetrating twins on (111) occur, but no lamellar structure is observed on the cube faces. Very thin splinters are translucent, doubly refracting, and pleochroic, and show traces only of lamellar structure. H = 5—6; fracture uneven. The mineral from Norrvik has sp. gr. = 4·21 (Anal. I); that from the limestone has sp. gr. = 4·288 (Anals. II and III).

	TiO_2.	FeO.	Ce_2O_3.	MgO.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
I.	54·12	4·19	6·81	—	33·32	0·79	0·38	0·21	99·82
II.	56·30	5·15	4·46	0·35	32·22	0·39		0·30	99·17
III.	54·52	4·94	4·42	0·32	32·84	1·68		0·92	99·61

The slight deviation from the formula RO,TiO_2 is explained by impurities (especially water and alkalis) and by decomposition.

L. J. S.

[Hainite in the] Phonolites of N. Bohemia. By Jos. Blumrich (*Tsch. Min. Mitth.*, 1893, **13**, 472—478).—In the ground-mass of the nepheline-phonolites of Hohen Hain, and other localities in N. Bohemia, are small, yellow, glassy needles and plates of a triclinic mineral, to which the name *hainite* is given. It is a silicate of sodium, calcium, titanium, zirconium, and cerium (?); sp. gr. 3·18; and is distinguished by its optical characters from the related minerals rinkite, låvenite, rosenbuschite, &c., these being the titanium and zirconium silicates, with fluorine, of elæolite-syenites. L. J. S.

Quartz-keratophyre of the Baraboo Bluffs, Wisconsin. By Samuel Weidmann (*Jahrb. f. Min.*, 1896, i, Ref. 266—267; from *Bull. Univ. Wisconsin*, 1895, **1**, 35—36).—The rock is effusive, and associated with quartzite; it contains numerous porphyritic felspars (anorthoclase and albite), quartz as strongly corroded grains, abundant biotite, and the accessories ilmenite, zircon, and magnetite. The ground-mass consists of holocrystalline quartz and felspar; fluidal, poikilitic and sperulitic structures are shown. Two analyses gave

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.
I.	71·24	12·20	1·71	5·44	0·98	0·13	1·86	4·29	0·81
II.	73·00	15·61	—	1·95	0·79	—	0·88	4·95	1·06

	MnO.	SO_3.	Total.	Sp. gr.
I.	0·97	—	99·63	—
II.	—	0·76	99·00	2·63

L. J. S.

Analysis of the Victoria Spring at Oberlahnstein. By C. Remigius Fresenius (*Jahrb. Nassau. Vereins*, 1893, *Jahrg.* **46**, 1—20).—Water from the new Victoria Spring at Oberlahnstein, in Nassau, is highly charged with carbonic anhydride, and has sp. gr. = 1·003969 at 17·5°; on standing, an ochre-coloured precipitate is formed, owing to the oxidation of the ferrous carbonate. Analysis gave in 1000 parts, Na_2CO_3, 0·992043; Li_2CO_3, 0·011954; Am_2CO_3, 0·005780; Na_2SO_4, 0·815738; NaCl, 1·311632; NaBr, 0·001626; NaI, 0·000011; Na_2HPO_4, 0·000978; $NaNO_3$, 0·004320; $Na_2B_4O_7$, 0·005901; K_2SO_4, 0·051616; K_2CO_3, 0·353078; $SrCO_3$, 0·000359; $MgCO_3$, 0·255014; $FeCO_3$, 0·012678; $MnCO_3$, 0·000878; SiO_2, 0·021676 = 3·845282; CO_2 (in bicarbonates), 0·715417; CO_2 (free), 1·515098 = 6·075797. Also traces of Rb_2SO_4, Cs_2SO_4, Na_3AsO_3, aluminium compounds, and organic matter. The water is compared with other table waters.

L. J. S.

Physiological Chemistry.

Digestion of Trehalose. By Emile E. Bourquelot and Eugène Gley (*Compt. rend. Soc. Biol.*, 1895, **11**, 555—557).—Maltose is converted into glucose by intestinal juice, pancreatic juice, and blood serum. Cane sugar and trehalose are similarly acted on by the intestinal juice, but resist the action of the ferment found in pancreatic juice and blood serum.

W. D. H.

Passage of Sodium Iodide from the Blood to the Lymph. By Lafayette B. Mendel (*J. Physiol.*, 1896, **19**, 227—239).—This is a contribution to the vexed question of lymph formation. The author supports Heidenhain's view that physical processes will not explain lymph formation. Sugar and sodium chloride occur in greater amount in lymph than in blood, and the same is true for sodium iodide after injection into the blood stream.

These facts are considered to bear out the doctrine of lymph-secretion.

W. D. H.

Chemical Composition of Enamel. By Charles S. Tomes (*J. Physiol.*, 1896, **19**, 217—223).—Great discrepancies exist in the analyses of the enamel of the teeth, various investigators giving numbers varying from 2 to 11 per cent. of organic matter. The organic matter is generally estimated by loss, and water is never set down as a constituent. The present paper shows that the loss on ignition is due to water, and, on attempting to estimate the organic matter directly, none was found, or a quantity too small to be weighable. This is in favour of the excretion theory of enamel development.

W. D. H.

Relation of the Liver to Fats. By DIARMID NOËL PATON (*J. Physiol.*, 1896, **19**, 167—216).—The liver is a gland which is not on the path of the fats absorbed from the intestine, but the fat can only enter it by the blood stream of the hepatic artery. The variation of the fat of the liver cells with food, nutrition, &c., is, however, a well-known fact, and the present paper seeks to elucidate some of the problems of metabolism in this direction.

After extraction with ether, the action of a mineral acid liberates a further amount of material soluble in ether (fatty acids), which is in part derived from soaps and in part from such compounds as nucleïns or lecith-albumins. The present research is concerned with the fatty acids extracted without acid. Any part of the organ may be taken for analysis, as the ether extract is uniformly distributed. In animals in the same condition, the percentage amount of substances soluble in ether is fairly uniform.

The results given in detail and in tabular form show that the ether extract of the liver gives a most imperfect indication of the amount of the essential (for nutritional purposes) constituents of the fats—the fatty acids; there must be other compounds besides normal fats present. In the first place, the liver fats contain a much smaller percentage of oleïc acid than the fats of other parts of the body; lower fatty acids are present in negligable amounts; the most important and constant compound other than fat in the liver extract is lecithin. The results recorded agree closely with those of Heffter (*Arch. exp. Path.*, **28**, 97), and show that lecithin comprises 2·35 per cent. of the liver and 9·7 per cent. of the solids present. It is largest during starvation and smallest during a fat diet. The liver seems to possess the important power of utilising and economising the phosphorus of the body by combining it with fatty acids to form lecithin as a stage in its conversion into the nucleïn compounds of the body. When the amount of lecithin is large, the acidity of the ether extract is great; when small, the acidity more nearly approaches that of the body fats; but with lecithin in the mixture, it is practically impossible to arrive at the amount of free fatty acid in the extract. The amount of cholesterol found in the extract is smaller than that given by Kausch; it amounts to 8—11 per cent. of the extract. Rather more than half of the fatty acids are present in the form of neutral fats. About 12 per cent. in the mean of the extract is not yet accounted for; it is in part pigment. Evidence is adduced that the fat is not simply stored in the liver from the blood, but is produced there. It disappears after it accumulates, but whether it is simply thrown out or metabolised is not manifest. There is certainly no simple conversion as with glycogen, for in the liver kept at the body temperature after an animal's death, but while the liver cells are still alive, there is no disappearance of the fat.

After storage from cat's milk in the case of kittens, no diminution occurs during inanition of 56 hours; but after 68 hours it has been got rid of in great measure. In pigeons, a four days' fast caused no alteration in the normal amount of liver fat. Excess of fat in the food is largely stored in the liver cell, from which it is gradually got rid of, but only after about 70 hours; there is no truth, however, in the statement that the amounts of fat and glycogen in any way correspond with one another. Diet rich in carbohydrates increases the liver fats, but not always in any marked degree; the fatty acids increase as the glycogen is disappearing, and are probably formed by the metabolism of glycogen. Excess of proteïd food does not lead to an accumulation of fat in the liver. W. D. H.

Transformation of Fat into Glycogen in the Silkworm during Metamorphosis. By E. COUVREUR (*Compt. rend. Soc. biol.*, 1895, **11**, 796—798).—On comparing the curves for the amount of fat and glycogen in the silkworm during its life history, they vary exactly inversely with one another. The loss of fat and corresponding gain in glycogen is most marked during the chrysalis stage.

W. D. H.

Assimilated Iron Compounds in Animal and Vegetable Cells. By A. B. MACALLUM (*Quart. J. Mic. Science*, 1896, **38**, 175—274; compare Abstr., 1895, ii, 518).—The paper relates to iron compounds other than hæmoglobin and hæmatin, and discusses their distribution in different parts of the animal and vegetable kingdom. The facts described indicate that a substance in which iron is firmly held is a constant constituent of the nucleus of the cytoplasm of non-nucleated cells, and in the cytoplasm of ferment-forming cells. This substance, chromatin, is not constant in its molecular structure, but its most marked character is the occurrence in it not only of iron but of nucleïn or nucleïc acid. The iron is possibly united to the carbon of the nucleïn; acid alcohols liberate it as a ferric salt, but this is no proof that it occurs in the ferric state in the nucleus.

It is difficult to state any difference between animal and vegetable cells. As a rule it is easier to liberate the iron with ammonium sulphide in vegetable cells; the same reagent liberates the iron of free hæmatin, although it does not affect hæmoglobin. Hæmoglobin is derived from chromatin, but is present in no vegetables; hence, probably, the iron is combined in animal chromatin in a way unlike that in which it is held in the vegetable cell. The use of iron absorbed from the soil is obvious, and a lack of iron affects not only the formation of chlorophyll, but strikes at the very life of vegetable cells. In the same way anæmia or chlorosis in vertebrates is not a lack of hæmoglobin due to want of organic or inorganic iron compounds in the food, and directly absorbed by the intestine, it is really due to a want of chromatin in the cells; and chlorosis may in this sense occur in animals which have no hæmoglobin. Chromatin has an oxygen-holding function like that of hæmoglobin, and this is intimately related to the life of a cell. In vegetables, the two processes of respiration and assimilation seem to involve two iron compounds in the same nucleus. The full consideration of this question, together with that of the rôle of sulphur and phosphorus in the nucleïn, is postponed. W. D. H.

Intestinal Absorption of Peptone. By E. WAYMOUTH REID (*J. Physiol.*, 1896, **19**, 240—261).—Grübler's peptone was used as a test proteïd. After precipitation by alcohol, it dissolves in hot (70°) 5 per cent. trichloracetic acid; and all other proteïds in the secretions of the gut are precipitable by the addition of an equal volume of 10 per cent. trichloracetic acid; to the filtrate, 10 per cent. of hydrochloric acid is added, and then a saturated solution of phosphotungstic acid to complete the precipitation. Nitrogen is estimated in this precipitate by the Kjeldahl process.

To recover unabsorbed peptone from the gut, very careful washing is required, and certain precautions, described in detail, are necessary. Experiments were made on dogs, loops of the intestine being measured off, and tied by tapes; into these recently exposed loops the peptone was injected; parallel experiments were always conducted on two loops. After a quarter of an hour, the dogs were killed, the loops were removed, and their contents examined. A table of six experiments is given, showing an absorption of from 40 to 70 per cent. of the peptone introduced; the difference between the two loops was never more than 5 per cent. W. D. H.

Urea in Animal Organs. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv*, 1895, **62**, 332).—By means of the method previously described by the author (this vol., ii, 131) he finds in the organs of a dog, with the exception of the muscles, heart, and kidneys, urea in quantity corresponding with that in the blood.

The muscles contain urea. This is a direct contradiction of the work of previous physiologists; it is present in too large an amount to be accounted for by the blood in the muscles.

Urea is a constituent of the red corpuscles, and is indeed about equally divided between blood corpuscles and blood serum.

W. D. H.

Physiological Action of Want of Oxygen. By JACQUES LOEB (*Pflüger's Archiv*, 1895, **62**, 249—293).—From a number of observations and experiments on the eggs of *Ctenolabrus*, and on the heart of the embryo of the same animal, the conclusion is drawn that want of oxygen first produces molecular and then morphological changes in the cells, which are the cause of bringing the vital activity of the organism to an end. Some of the cells of this animal become liquid with the loss of oxygen, but on admission of air they are formed afresh. In embryos, like that of the *Fundulus*, deprivation of oxygen produces no change in the cells of the heart, which continues beating for many hours, whereas in *Ctenolabrus* the change in the cells is marked, and the standstill very suddenly produced.

W. D. H.

Comparison of the Action of Cadmium and Zinc Salts. By ATHANASIU and PAUL LANGLOIS (*Compt. rend. Soc. Biol.*, 1895, **11**, 496—497, 719—722).—The symptoms of poisoning by zinc and cadmium salts are identical; the dose only differs. The most marked symptom is muscular paralysis, the cerebral centres being first affected; the heart, moreover, is slowed and weakened, being governed only by its own local ganglia. The experiments were made on frogs and turtles, but in all experiments a difficulty was found in obtaining blood serum free from hæmoglobin. Experiments made on Hamburger's plan showed that the injection modified the isotony of the blood, leading to a liberation of hæmoglobin, a partial formation of hæmatin, an increase in the amount of serum-globulin, and a general profound alteration in the red corpuscles, especially with cadmium salts. W. D. H.

Indican and Indole in the Tissues of Tumours. By NEPVEU (*Compt. rend. Soc. Biol.*, 1895, **11**, 475—476).—In five specimens of cancerous tumours, indican and indole were found. W. D. H.

Behaviour of Caffeïne and Theobromine in the Organism. By MANFREDI ALBANESE (*Gazzetta*, 1895, **25**, ii, 298—321).—The administration of large doses of caffeïne to dogs is followed by a greatly increased secretion of urine, from which a monomethylxanthine, $C_6H_6N_4O_2$, probably identical with that obtained by Salomon (Abstr., 1886, 266), may be separated. A dose of 1 gram of methylxanthine administered hypodermically to a dog weighing 8 kilos. caused death in 10 days; in smaller doses, it acts as a diuretic, and must be considered as an intermediate product in the transformation which caffeïne undergoes in the organism, for very little of it is excreted when hypodermically injected. After the administration of caffeïne in the food of a dog, small traces of it can be extracted from the urine.

Xanthine is not a normal constituent of the urine of rabbits; after administering caffeïne, the urine contains small quantities of caffeïne but no methylxanthine. A dimethylxanthine, $C_7H_8N_4O_2$, and caffeïne can be separated from human urine after caffeïne has been taken internally.

It is thus evident that in its passage through the organism, methyl groups are removed one by one from caffeïne until xanthine is finally obtained, and converted into ammonia and urea.

Methylxanthine, injected into the jugular vein of rabbits, acts as a very powerful diuretic, the secretion of urine being increased to more than 40 times the normal.

Theobromine, when administered internally to dogs, behaves like caffeïne; small quantities of it are excreted, and a larger proportion appears in the urine as methylxanthine. W. J. P.

The Cholesterol of Human Fæces. By STANISLAS BONDZYŃSKI (*Ber.*, 1896, **29**, 476—478).—Human fæces contain a substance which is apparently closely connected with cholesterol, but differs from it in some important particulars; to this the author proposes to give the name *koprosterol.* This substance can be extracted from the fæces by the application of the usual method for isolating cholesterol. It is insoluble in water and alkalis, soluble in alcohol, chloroform, ether, carbon bisulphide, benzene, and light petroleum. It crystallises in long, slender, pliable needles, melts at 95—96°, and is dextrorotatory, $[\alpha]_D = +24°$.

Analyses lead to the formula $C_{25}H_{44}O$, whilst the formula of cholesterol is $C_{27}H_{46}O$. The *benzoate* crystallises in rectangular tablets, and melts at 114—115°. Koprosterol gives the same colour reactions as cholesterol; it never appears to be accompanied by the latter in the fæces. A. H.

Chemistry of Vegetable Physiology and Agriculture.

Fractional Fermentation of Cane Sugar with Pure Yeasts. By WILLIAM L. HIEPE (*J. Fed. Inst. Brewing*, 1895, **1**, 288—322).—A considerable number of experiments are described, in which solutions of cane sugar were fermented with pure cultures of various types of yeast. Samples were withdrawn for analysis before the addition of the yeast, five minutes after the latter had been added, and afterwards at intervals of 24 hours, the fermentation being conducted at the ordinary temperature. Amongst the results recorded, it was found that the rate of inversion, and also of fermentation, varied greatly with different species of yeast. Thus, the smallest percentage of cane sugar inverted during the first five minutes was 1·95, and was produced by Chesters' yeast, whilst the greatest inversion occurring within the same period was 58·85, and was produced by a low fermentation yeast (Jörgensen's No. 84). In the case of two low fermentation yeasts (Jörgensen's Nos. 84 and 304), inversion was complete within 24 hours, whilst the longest time for complete inversion was 11 days (*Sacch. exiguus*), Chesters' yeast requiring 7 days. There appears to be no close relationship between the rates of inversion and fermentation by a yeast, although in several cases a slow inversion corresponds with a slow fermentation. In all cases, the dextrose is fermented more rapidly than the levulose, the amounts of the former fermented within 24 hours varying between 1·27 and 22·88 per cent., the corresponding numbers for levulose being 0·19 and 14·04 per cent. for the same yeasts. Towards the end of the fermentations, the quantities of the two sugars fermented approximate to one another, and the last portions disappear together. In order to determine whether there is any retarding action on the fermentation owing to the fact that the yeast has first to invert the cane sugar, experiments were made in which the cane sugar was first inverted, and then the rate of fermentation of the resulting invert sugar was determined. It was found that in the case of No. 84 yeast (which inverts rapidly) the rate of fermentation was nearly the same as with cane sugar, whilst in the case of Chesters' yeast (which inverts slowly) there was a considerable increase in the rate of fermentation.

A. K. M.

Bacterial Infection by Air-sown Organisms. By HORACE T. BROWN and G. HARRIS MORRIS (*J. Fed. Inst. Brewing*, 1895, **1**, 14—21).—In this paper the authors show how they were able to trace to its source (putrefying offal and other filth in adjoining premises) a case of bacterial infection in a certain brewery, the beers of which had from time to time shown a tendency to develop *ropiness* or viscosity. The particular organism associated with this malady was not the *Bacillus viscosus* of van Laer, but a small *coccus* occurring in the diad and tetrad form. Although the organism mentioned was invariably found in all samples of the ropy beer, the authors were able in only one or two cases to induce ropiness by its addition to sterile beer; the production of viscosity evidently depending on certain conditions of nutriment which were not present in all beers.

A. K. M.

Bacillus subtilis. By ADRIAN J. BROWN (*J. Fed. Inst. Brewing*, 1895, **1**, 423—426).—The non-identity of *Bacillus subtilis* with the long, thin bacterium found in ale of doubtful stability has been established by van Laer, who named the latter *Saccharobacillus pastorianus*. Owing to the abundance of *Bacillus subtilis*, however, this organism must frequently gain access to brewers' worts and ales, and the author has therefore made some experiments, in order to ascertain if it can become a source of danger. He finds, however, that this organism cannot grow in either wort or beer having a normal acidity. If the acidity is neutralised by the addition of calcium carbonate, a growth of the organism will readily occur, although the growth in the neutralised wort is not as vigorous as in the neutralised beer. It was also found that a growth of *B. subtilis* could be obtained in a neutral infusion of hay to which 5 per cent. of dextrose was added, but when, through the action of the bacillus on the sugar, the acidity reached 0·04 per cent., the growth and action of the ferment entirely ceased. If, on the other hand, calcium carbonate was added to neutralise the acid when formed, the growth and action continued until the whole of the sugar was decomposed.

The fact that *B. subtilis* is an aërobic organism, and that the normal amount of acid present in wort and beer prevents its growth, shows that this organism is not a source of danger to the brewer.

A. K. M.

Alcoholic Fermentation arrested by Substances secreted by Aspergillus niger. By EMILE E. BOURQUELOT and H. HÉRISSEY (*Compt. rend. Soc. Biol.*, 1895, **11**, 632—635).—Aqueous extracts of cultures of this mould contain very little solid, but act hydrolytically on cane sugar, maltose, inulin, trehalose, &c., and at the same time lessen alcoholic fermentation if yeast is added as well.

W. D. H.

Fermentation of Maltose by the Mould Eurotiopsis Gayoni. By J. B. VINCENT LABORDE (*Compt. rend. Soc. Biol.*, 1895, **11**, 472—474). By EMILE E. BOURQUELOT (*ibid.*, 474—475)—The first paper relates to the action of a newly discovered mould *Eurotiopsis Gayoni.*

When this is added to a solution of maltose, the sugar is fermented without any appreciable formation of glucose. But the glucose is probably fermented as quickly as it is formed; and in a mixture of maltose and glucose, the latter increases for a time in quantity as the fermentation proceeds.

Bourquelot points out that this is always the case with moulds; maltose, like cane sugar, is not directly fermentable with yeast, but is first converted, by a soluble ferment secreted by the organism, into glucose, a statement recently confirmed by E. Fischer.

W. D. H.

Action of Friedländer's Pneumococcus on Sugars. By Léon Grimbert (*J. Pharm.*, 1895, [6], 2, 529—533).—The author worked with *Pneumococcus* emanating from the Pasteur Institute, and having all the characters attributed to Friedländer's *Pneumococcus*, using for medium a solution containing 3 parts of fermentable sugar, 2 parts of dry peptone, and 100 parts of water, to which pure calcium carbonate was added, the whole sterilised, and, after seeding, maintained at a constant temperature of 36°. The results obtained are set forth in the following table, the weights being per cent. of the sugar used.

	Days fermenting.	Ethylic alcohol.	Acetic acid.	Lactic acid.	Succinic acid.
Glucose	30	trace	11·06	58·46	none
Galactose	10	7·66	16·60	53·33	"
Arabinose	69	none	36·13	49·93	"
Mannitol......	38	11·40	10·60	36·63	"
Glycerol	30	16·66	19·70	45·53	"
Saccharose	60	trace	29·53	+	+
Lactose.......	24	16·66	30·66	trace	26·76
Maltose.......	68	trace	35·53	+	+
Dextrin.......	12	mixed with higher alcohols	10·13	none	13·96
Dulcitol.......	5	29·33	9·46	"	21·63
Potato	68	none	+	"	+

The sign + indicates that both acids were present, but could not be determined; no formic acid was observed in any case. It is interesting to note that mannitol gives lactic acid, whilst its isomeride dulcitol yields succinic acid, that the C_{12} sugars give both lactic and succinic acids, &c., &c. Attention is drawn to the fact that these results differ considerably, both in the character of the products and the activity of the organism, from those obtained by Frankland, Stanley, and Frew (Trans., 1891, **59**, 253—270), which, it is suggested, points to there being at least two forms of *Pneumococcus* (Friedländer) morphologically similar, but differing considerably in their fermentative actions; a cultivation in glycerol with chalk will determine which of the two any future worker may be dealing with.

D. A. L.

Nature of Fermentative Changes in Natural and Polluted Waters, and in Artificial Solutions, as indicated by the Composition of the Gases in Solution. By Walter E. Adeney

(*Trans. Royal Dublin Society*, New Series, 5, Part XI).—The author has described in this communication a method, and special apparatus, for studying, quantitatively, the changes in composition of the dissolved gases in liquids, which may accompany fermentative changes in the same.

Experimental results are given in the paper to show that for this purpose water solutions can be preserved completely out of contact with air for long periods, extending to as much as a year, without suffering appreciable loss of or gain to the gases they hold in solution, either by escape of gas, or by access of air, by simply keeping them in bottles completely filled and carefully stoppered with glass stoppers, the bottles themselves being kept immersed neck downwards, in distilled water in large glass vessels which are covered with glass plates.

The method of experiment has been modified, according as it had been desired to observe the total changes in composition of the dissolved gases during a complete, or a partial, aërobic fermentation, or to study the changes which occur progressively during an aërobic fermentation from commencement to completion, at intermediate stages.

To effect the first purpose, a strong solution of a polluted water, or of organic and inorganic substances, of known strength and composition, in either of which the quantities of fermentable matters might be regarded as in decided excess relatively to that of the dissolved oxygen therein, has been taken as the basis of a number of gradually increasing dilutions with good tap-water, or when necessary, with pure water. In this way, a series of dilutions, gradually decreasing in strength, of the solution under experiment has been obtained, and the changes in composition of the dissolved gases during fermentation, have been determined in each.

The results which have followed indicate, quantitatively, the changes which have occurred during the fermentation of the substances therein, under the varying conditions, from those in which the fermentable matters were in excess, to that in which the dissolved oxygen was in excess.

To effect the second purpose, a large quantity of a strong solution of a polluted water, or of an artificial solution of known strength and composition, and occasionally one or two dilutions thereof, have been employed. These have been allowed to ferment for a sufficient period, and the accompanying changes in composition of the dissolved gases have been determined. The portion of the solution remaining from this operation has been again aërated, and allowed to ferment for a further period, and the products of the fermentation again estimated. These operations have been repeated until the fermentation has reached a desired stage, or has been completed. In this way, it has been possible to examine the products of fermentation, as it has gradually proceeded step by step, from commencement to completion, under well defined conditions.

By the method thus briefly outlined, it has been possible to study fermentations carried on under continued aërobic conditions in all parts throughout the mass of the fermenting liquid, from commencement to completion, or to any desired intermediate stage.

In all the experiments recorded in this paper the changes in composition of the inorganic nitrogenous substances present in the solution employed, which have occurred during fermentation, have been determined in addition to the changes in composition of the dissolved gases.

The following conclusions have been drawn by the author from the experiments recorded in this paper.

1. That the method and apparatus described in the paper for preserving natural waters, or artificial solutions, out of contact with air, and for analysing the gases in solution in them before and after keeping, are capable of yielding very accurate results, and that the method is not attended with any great experimental difficulties.

2. That observations of the changes in composition of the gases in solution, which take place during the course of fermentation in the presence of mixed organisms, under the conditions described, when made in conjunction with an examination of the changes which simultaneously occur in the organic and inorganic nitrogenous substances in the water, are productive of extremely important results, and are necessary if it be desired to investigate completely the chemical changes which accompany such fermentations.

3. That with the aid of such observations it is possible to study the various chemical changes which take place progressively during the fermentation, within certain well defined conditions, of any fermentable substance or substances, from commencement to completion at any intermediate step desired.

4. That it hence becomes possible to demonstrate that the fermentation of substances under aërobic conditions, and in the presence of the organisms usually present in water, takes place progressively in two distinct stages: (1) that in which the organic substances are completely broken down, the carbon and nitrogen being largely converted into carbonic anhydride and ammonia, a little organic matter remaining as such, but in an altered form; and (2) that in which ammonia is oxidised to nitrous or nitric acids, or both.

5. That the first stage of fermentation must be complete before the second stage can set in.

6. That the *organic* substances which result as products of the first stage of fermentation, may undergo further change during the subsequent stage, and give rise to the formation of carbonic anhydride and possibly also to nitric acid.

7. That peaty matters when present alone in a water undergo very slow change, but when present with ammonium compounds in a water, they readily undergo fermentation together with the ammonium compounds, just as the organic matters, which, as above stated, are formed during the first stage of fermentation of animal, vegetable, or artificial organic substances, do during the after-fermentation of ammonium compounds which may have been also formed thereby, or which may have been previously present or added.

8. That the above-mentioned fermented organic matters, and also peaty matters, appear to determine the *nitric* fermentation of *ammonia*, since in their complete absence, similar organisms being present, only nitrous acid is obtained.

9. That during the intermediate stages of a fermentation of mixed peaty matters and ammonium compounds, various interchanges between the two appear to take place, the character and extent of which apparently depend on the relative quantities of peaty matters, ammonia, and dissolved oxygen present, and also on the character of the peaty matters themselves, whether they have been freshly formed, or have undergone any previous fermentative changes.

10. That in the presence of small quantities of peaty, or other fermented organic matters, carbonic anhydride and ammonia may become "fixed" during fermentation, in appreciable quantities, no doubt, from Winogradsky's researches, to form organic matter.

11. That the formation of 1 part by weight of nitrous nitrogen during the fermentation of ammonia, in the complete absence of organic matter, is attended by the consumption of about 4·2 parts by weight of oxygen.

12. That for similar volumes of oxygen consumed, the quantity of nitrogen oxidised during the fermentation of ammonia is distinctly greater, in the presence of peaty or other fermented organic matters, than in their absence.

13. That for similar volumes of atmospheric oxygen consumed, the quantities of carbonic anhydride and of ammonia "fixed" are also more appreciable in the presence of those organic matters, than in their absence.

14. That the observed facts in reference to nitrification may be summarised as follows.

(*a.*) The nitrous organisms of soil thrive in inorganic solutions containing ammonia.

(*b.*) The nitric organisms of soil are gradually killed, or lose their vitality, in organic solutions containing ammonia.

(*c.*) The nitric organisms of soil thrive in inorganic solutions containing nitrites.

(*d.*) The nitrous organisms cannot oxidise nitrites to nitrates in inorganic solutions.

(*e.*) The presence of peaty or humus matters appears to preserve the vitality of nitric organisms during the fermentation of ammonia, and establishes conditions whereby it is possible for the nitric organisms to thrive simultaneously in the same solution with the nitrous organisms.

Query—Is it possible for either the nitrous, or nitric, or other organisms to separately set up the complete oxidation of ammonia to nitric acid, in the presence of peaty or humus matters?

15. That by determining the changes in the composition of the dissolved gases, and in that of the organic and inorganic nitrogen compounds, which accompany fermentation in natural and polluted waters, it is possible not only to differentiate easily fermentable from difficultly fermentable substances present in them, but to approximately estimate their quantity.

16. That such determinations are of very great value in the case of polluted waters, because, in addition to affording very accurate estimations of the total quantities of fermentable matters in them, in

terms of the exact volume of atmospheric oxygen necessary for their complete fermentation, it is possible by proper examination to determine what fraction of such volume is required for the first stage of fermentation, and what fraction for the second—distinctions of the utmost importance in considering the technical aspect of the question of the pollution of rivers.

A number of experiments on the fermentation of pure urea, *unmixed with any other fermentable organic substance of any kind*, are also quoted, the results of which show that the fermentation of this substance is apparently anomalous. Thus, from the earliest stage of fermentation of a very strong solution of pure urea, *aërobic conditions being established throughout the mass of the solution*, nitrous acid, in addition to ammonia, was formed, the proportion of nitrous to ammoniacal nitrogen being as 1 : 4. The author believes, however, that the chemical changes which result in this case in the formation of nitrous acid are not analogous to those attending the formation of that substance during the fermentation of ammonia, but rather to those attending the formation of fermented organic matters during the first stage of their fermentation, the nitrogen in the case of urea taking the place of the carbon in a more highly carbonated organic compound.

The author points out that a new term is required to designate the process of the first stage fermentation, described in the paper, which organic substances undergo, and proposes to employ the term "bacteriolysis" for the purpose, and to reserve that of nitrification to describe the fermentation of ammonium compounds. W. E. A.

Effect of Alkaloïds on the Germination of Seeds. By Ugolino Mosso (*Ann. Agr.*, 1895, **21**, 544; from *Arch. ital. Biol.*, **21**, 231).—In experiments with the seeds of *Phaseolus multiflorus* it was found that cocaïne and atropine* (0·01 per cent.), strychnine (0·05 per cent.), morphine (0·001 per cent.), and atropine* (0·0005 per cent.) assist, whilst more concentrated solutions retard, germination. Caffeïne (salicylate) was not favourable owing, perhaps, to the presence of salicylic acid. According to the amount given, it seems that alkaloïds exercise a narcotic or a stimulating effect on plants as well as on animals. N. H. J. M.

Philothion and Laccase in Germinating Seeds. By Joseph de Rey-Pailhade (*Compt. rend.*, 1895, **121**, 1162—1164).—Some germinating seeds, such as beans, peas, chick-peas, white lupins, haricots, soja, wheat, maize, chestnut, Indian chestnut, maple, and ginkgo, contain both philothion and laccase; others, such as pine kernels, contain philothion and no laccase, whilst a third group, including castor-oil seeds, radish, gourd, Marvel of Peru, bind-weed, and potato tubers contain laccase, but not philothion, and a fourth group (acorn, laurel) contains neither, or only minute traces, of these compounds.

When the seeds contain laccase, this substance is present before absorption of water has taken place; but the quantity increases continuously as germination progresses. Philothion, on the other hand, is found in very small quantity in the dry seeds, and is concentrated in the embryo; it becomes more abundant after the seeds have been moistened, but disappears after a few days.

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* One of these should probably be nicotine, which was also one of the compounds experimented with.

Under the combined action of laccase and oxygen, philothion oxidises rapidly, with production of carbonic anhydride; but laccase alone has no action on it, and in presence of oxygen alone, it oxidises very slowly. It follows that, under the influence of laccase, philothion combines rapidly with free oxygen, and produces carbonic anhydride, thus contributing to the respiration of the seeds.

C. H. B.

Distribution of Boric acid in Nature. By HENRY JAY (*Compt. rend.*, 1895, **121**, 896—899).—The author has applied the method previously described (this vol., ii, 76) to the detection and estimation of boric acid in various products of vegetable origin. Wines contain from 0·009 gram to 0·033 gram per litre, the mean being 0·017 to 0·023 per litre. The ash of wine contains from 4·7 to 16·5 grams per kilo., the average being from 8 to 12 grams. The ash of the marc contains from 1·4 to 3·5 grams per kilo., the average being 2·4 to 2·7 grams. The quantity in the ash of vine leaves is only about 0·7 gram per kilo.

Examination of a large number of fruits, leaves, &c., leads to the result that the ashes of fruits, whether fleshy or stony, contain from 1·5 to 6·4 grams of boric acid per kilo.; in the ash of seaweeds, plantain leaves, chrysanthemum flowers, and onions, the quantity varies from 2·1 to 4·6 grams per kilo. *Gramineæ* and certain fungi, on the other hand, absorb very little boric acid from the soil, and their ashes contain not more than 0·5 gram per kilo. The acid can also be recognised in the ashes of many coals, and many specimens of sea salt, and also in minute quantities in some river and spring waters.

The milk and the blood of the cow, mare, and sheep contain no recognisable quantity of boric acid even in the ash from 1 kilo., but the urine of a cow contained 0·0086 gram per litre, and the urine of a horse 0·0075 gram per litre. It seems, therefore, that when boric acid is introduced in small quantities into the stomachs of animals, it is not assimilated, but is eliminated with the urine and the other excretions.

C. H. B.

Hydrogen Cyanide in Pangium Edule Reinlw. By M. TREUB (*Rec. Trav. Chim.*, 1895, **14**, 276—280).—The author shows that the hydrogen cyanide in *Pangium edule* is not one of the substances which afterwards go to form the proteïd matter.

The formation of this hydrogen cyanide does not appear to be directly affected by light, but there is apparently a definite relationship between its formation and the assimilation of carbon. In this connection, the author states that the presence of carbohydrates, and also of certain inorganic substances taken from the soil, is an indispensable condition for the formation of the acid in question. As regards the carbohydrates in the leaves of the plant, the author proves the presence of a reducing sugar, which yields phenylglucosazone, and which is, therefore, probably glucose or fructose.

In conclusion, the author considers that hydrogen cyanide is not merely the first recognisable nitrogenous organic substance, but is absolutely the first nitrogenous organic compound to be formed, and that by its means amides, which play so important a part in vegetable physiology, may readily be formed. In support of this view, it is shown that hydrogen cyanide occurs in numerous families of plants not at all related to Pangium. J. J. S.

Methylic Salicylate and Salicylic acid in the Root of Polygala of Virginia. By AUGUST SCHNEEGANS (*J. Pharm.*, 1895, [6], **2**, 452—453).—Polygala root is found to contain 0·01 per cent. of methylic salicylate and 0·06 per cent. of free salicylic acid; the latter is readily detected by twice extracting 5 or 10 grams of the dried roots with ether, filtering, evaporating, treating the residue with water, and testing with ferric chloride. D. A. L.

Accumulation of Sugar in the Root of the Beet. By LÉON MAQUENNE (*Compt. rend.*, 1895, **121**, 834—837).—No explanation has hitherto been advanced of the fact that the carbohydrates elaborated by the chlorophyllous cellules travel by diffusion into the root, but do not subsequently travel back to the leaves by a similar process. It is known, however, that the carbohydrates take the form of reducing sugars when they ascend in the plant, and of saccharose when they descend. The author regards the phenomenon as one conditioned by osmotic equilibrium; if two cellules are in communication with one another, and one contains reducing sugars, and the other saccharose, then, in accordance with well-known laws, they will exchange contents. If, however, the two cellules are those of a living beetroot, since the carbohydrates can only exist in one in the form of reducing sugars, and in the other in the form of saccharose, equilibrium will never be established, although the circulation of water will continue. Since osmotic pressures are inversely as the molecular weights, it is essential to equilibrium that the concentration of the saccharose solution be double that of the reducing sugars; if, therefore, by reason of assimilation, the osmotic pressure in the leaves increases, the principles elaborated will travel towards the root, and take the form of saccharose; if the pressure in the leaves diminishes, the saccharose in the root will split up and travel into the leaves. Cryometric measurements show that the osmotic pressures of the juice of the leaves and the juice of the root are practically identical, although that of the leaves is generally slightly lower than the other, the difference being of the same order as that which usually exists between the soil and the atmosphere.

The author states, as a general principle of vegetable physiology, the law that any proximate principle can accumulate if its formation results in a reduction of osmotic pressure. For this reason, the principles that do accumulate are always of a highly condensed character. C. H. B.

Toxicity of Copper Salts. By W. O. ALEXANDER TSCHIRCH (*Ann. Agron.*, 1895, **21**, 544; from *Chem. Zeit.*, 1894, **18**, No. 102).—Contrary to what is usually supposed, copper is not poisonous to plants. Whilst the sulphate, nitrate, and chloride are corrosive, plants take up copper without injury from soils containing insoluble copper compounds. Haricots grew better in nutritive solutions to which 0·06 per cent. of copper oxide was added, than in absence of copper.

Frank and Krueger (*Ann. Agron.*, 1895, **21**, 42) showed that the copper-lime preparation had a beneficial effect on the development of potatoes. N. H. J. M.

Transformations which Nitrogen undergoes in the Soil. By A. Pagnoul (*Ann. Agron.*, 1895, **21**, 497—501). **Effect of Carbon Bisulphide and of Horse Dung on Denitrification.** By Pierre P. Dehérain (*ibid.*, 501—508).—Six pots of soil (25 kilos. each) containing superphosphate (20 grams) and potassium chloride (20 grams) were further manured as follows: A, sodium nitrate (30 grams); B, the same as A with the addition of horse dung (500 grams); C same as B with the addition of carbon bisulphide (50 c.c.). The soil of these pots was kept bare from 24th May to 21st June, when grass was sown; the grass was cut 23rd July and 23rd August. A similar set of pots *a*, *b*, and *c*, where sown with white mustard. The following amounts of grass (A, B, C) and of white mustard (*a*, *b*, *c*) were obtained (in grams).

A.	B.	C.	*a.*	*b.*	*c.*
184	251	207	234	357	283

There was no denitrification under the influence of the organic manure, as was indicated by Wagner's recent experiments (*J. Agric. prat*, 25th August, 1895). Two other sets of experiments were made similar to the above, except that ammonium sulphate (25 grams) was substituted for nitrate. The total amount of grass (D, E, F) and of mustard (*d*, *e*, *f*) were:—

D.	E.	F.	*d.*	*e.*	*f.*
182	190	179	69	229	147

The following table shows the amount of nitrogen (milligrams per cent. in soil) as ammonia, as nitrites, and as nitrates at different dates in the fallow and grass experiments (D, E, and F). The results with mustard (*d*, *e*, *f*) are also given in the paper.

Dates.	D. Am_2SO_4 alone.			E. Am_2SO_4 + dung.			F. Am_2SO_4 + dung + CS_2.		
	N. in soil as			N. in soil as			N. in soil as		
	HNO_3.	HNO_2.	NH_3.	HNO_3.	HNO_2.	NH_3.	HNO_3.	HNO_2.	NH_3.
24th May .	2·77	1·26	39·37	4·16	1·15	33·00	trace	0·04	50·40
11th June.	14·95	13·00	2·47	15·41	10·05	2·55	,,	0·08	36·85
21st June .	18·76	23·11	1·54	22·08	15·52	0·69	,,	0·84	28·14
8th July . .	11·89	0·12	0·63	13·79	0·14	0·63	15·53	6·75	0·67

In these experiments, there is again no evidence of denitrification under the influence of the organic manure. In experiment F (with carbon bisulphide), nitrification was suspended for a considerable time. In comparing the results obtained with nitrate and with ammonium sulphate respectively, it is seen that nitrate was the more efficacious, both with grass and with mustard.

As regards the effect of carbon bisulphide in checking nitrification, Dehérain calls attention to Girard's experiments (*Ann. Agron.*, 1894, **20**, 478) with beet, and points out that great loss of nitrogen (through drainage) may be prevented or diminished by hindering nitrification in this manner; the following year nitrification would be energetic and produce large crops. The different results obtained by Pagnoul and by Wagner respecting the denitrifying effect of horse dung may possibly be due to the horses having been differently fed, and on the consequent difference in the nature of the micro-organisms present in the fæces. Thus, according to Bréal (*Ann. Agron.*, **18**, 181) leguminous plants reduce nitrites less vigorously than gramineous plants, so that the fæces of a horse fed with oats and lucerne hay with a little straw would reduce nitrates more readily than if gramineous hay and much straw had been given in addition to oats.

N. H. J. M.

Action of Sodium Chloride and Nitrate and of Phosphates on the Solubility of the Potassium of the Soil. By NAPOLEONE PASSERINI (*Ann. Agron.*, 1895, **21**, 494; from *Atti. R. Accad.*, 1894, **75**, 15).—Soil, in quantities of 500 grams, to which sodium chloride, mono- and tri-calcium phosphates, and sodium nitrate, respectively, (20 grams each) had been added, was kept in glass pots for six months, one set being kept damp, another dry. The soil contained $K_2O = 1{\cdot}23$ per cent. At the end of the experiment, each pot of soil was extracted with 1 litre of boiling water. The moist soil treated with sodium chloride yielded 0·183 gram of soluble potash more than soil without the addition of salt, whilst in the case of the dry soil (with NaCl) there was an excess of 0·072 gram of soluble potash. Sodium chloride also caused greater solubility of lime and magnesia.

Monocalcium phosphate rendered soluble 0·0125 gram of potash in the damp soil, and 0·010 gram in the dry. Tricalcium phosphate had no appreciable effect. The effect of sodium nitrate was to give an excess of potash = 0·143 gram in the damp, and 0·097 gram in the dry soil, and to very much increase the solubility of the lime and magnesia in the soil.

It is generally useless to manure, with potash, soils which receive sodium nitrate and superphosphate. N. H. J. M.

Analysis of the Soil by Plants. By G. LECHARTIER (*Compt. rend.*, 1895, **121**, 866—870).—Although the quantities of various inorganic compounds absorbed by plants from the soil depend on the nature of the plant and the composition of the soil, the proportion of each substance so absorbed must not fall below a certain minimum amount necessary to the normal growth of the particular plant. The author's previous researches on the Jerusalem artichoke have shown that a comparison between the composition of normal leaves and that of leaves which have changed prematurely, gives definite and valuable information as to the constituent that is wanting in the soil in an assimilable form. Some new experiments with lucerne lead to the same conclusion. A crop was grown for several years in succession on a field, parts only of which received potash manures at two different times, and it was found that as the potassium in the soil was used up, the lucerne became much thinner, the separate plants much lower in height, and the leaves smaller, yellowish, and in part discoloured.

So far as the proximate composition of the organic portion of the plant is concerned, the different crops showed no practical differences. The inorganic constituents of the plants with normal development, varied between the limits already known, and the composition of the separate plants on each plot was remarkably constant. Further, the plants which changed prematurely did not differ appreciably from the normal plants in the proportions of calcium, magnesium, phosphoric acid, or sulphuric acid which they contained, but the proportion of potassium in the atrophied plants was only half that in the normal plants, and was in fact reduced from 1·567 per cent. of potassium oxide in the dried plant to 0·742 per cent. This last quantity may be regarded as a minimum proportion below which the lucerne ceases to grow in a normal manner. C. H. B.

Field Experiments [with Wheat and Barley] at Grignon in 1895. By PIERRE P. DEHÉRAIN (*Ann. Agron.*, 1895, **21**, 545—565; compare Abstr., 1895, ii, 179).)—In the north, where farmyard manure and commercial manures are largely employed, the rotation is generally reduced to two courses, wheat and beet, with lucerne occasionally; in some parts where beet is replaced by mangel-wurzel or potatoes, and barley and clover are included in the rotation, it is found advisable to grow wheat after roots (manured), or else, as in the Norfolk rotation, in the fourth course after the leguminous crop. Both after well manured roots and after Leguminoseæ, very good crops of wheat are obtained, but it may be advisable to apply a little sodium nitrate, and perhaps also superphosphate in the spring; and attention is again drawn to the great benefit derived by careful preparation of the soil, by which nitrification is much increased.

The field experiments now described are a continuation of the earlier ones; different varieties of wheat were employed and the manuring and treatment of the soil were varied. The results are given in full in tables.

Australian wheat, without direct manure, yielded 40 metric quintals of grain per hectare, both after beet and after potatoes, whilst two other varieties (Scholley and Porion) gave much smaller yields, even when they received sodium nitrate in small quantity. When Australian wheat succeeded a leguminous crop, the yield was only an average one, even with direct manuring in addition to the residue left by the leguminous plant.

The application of nitrate had a remarkably slight effect on the crops, and this is supposed to be due to the active nitrification rendering such application superfluous. The temperature from October to December had been relatively high. N. H. J. M.

Employment of Quicklime in the Cultivation of Leguminoseæ. By AUGUST SALFELD (*Ann. Agron.*, 1895, **21**, 535—536; from *deut.-landw. Presse*, 1894, **21**, 785).—A poor sandy soil, for a long time cultivated, and well manured with kainite and basic slag in 1893, was divided into two halves, to one of which quicklime (2000 kilos. per hectare) was applied in the summer, to the other marl (containing a corresponding amount of lime). The following February (1894) some plots were inoculated with soil from old pea land, and were subsequently sown with peas (two kinds). Two kinds of lentils and *Lathyrus clymenum* were also sown, but for these, the soil was not inoculated. In June, after frequent rain, the marled plots were well covered with green vegetation, whilst the plants of the limed plots were generally yellow. Nodules were found on the roots of the green plants, but not on those of the yellow plants.

The following amounts in kilograms per hectare were obtained.

	Pisum sativum (inoculated).	*Pisum arvense.* (inoculated).	Lentils (not inoculated).
Marl........	2459	2613	894
Quicklime....	804	1368	173

The quicklime destroyed the nodule bacteria and should not be applied to soil on which it is intended to grow *Leguminoseæ*, but if marl is not available, the soil may be limed for cereals which precede *Leguminoseæ*; in this case it might be necessary to inoculate the soil.

N. H. J. M.

Analytical Chemistry.

Gas Analysis. By M. SCHATERNIKOFF and IWAN M. SETSCHENOFF (*Zeit. physikal. Chem.*, 1896, **18**, 563—571).—The authors describe a modification of Bunsen's apparatus for eudiometric gas analysis, which is capable of speedier and more accurate measurements than the ordinary form. Illustrations of the apparatus are given, and the methods of the analysis described, whilst examples of the analysis of air show that the apparatus is capable of yielding consistent and accurate results.

L. M. J.

Characteristic Colour Reaction for Chlorates. By GEORGES DENIGÈS (*J. Pharm.*, 1895, [6], **2**, 400—402).—One or two drops of the suspected liquid is mixed with 2 c.c. of pure sulphuric acid, and cooled by immersion and agitation in cold water; 5 drops of the resorcinol solution already described (this vol., ii, 337) is added steadily, the tube again immersed in cold water, and gently shaken; if the amount of chlorates in the solution does not exceed 2 per cent., a green coloration is produced, even with 0·00001 gram of a chlorate, so the test is best made in a dilute solution, 0·2 per cent., for instance. Nitrates, under similar conditions, give a feeble, yellow coloration, changing to violet-red on heating. The strong coloration due to a nitrite would mask the chlorate colour, so nitrites must be removed by treating 2 or 3 c.c. of the solution with 1 or 1·5 c.c. of ammonia, filtering, supersaturating with acetic acid; evaporating 1 or 2 c.c. to 4 or 5 drops by boiling in a tube and shaking, then adding 10 to 15 drops of water, and treating the solution as above with sulphuric acid and resorcinol solution. Chromates, permanganates, &c., are removed by means of ammonium sulphide, and the solution subsequently supersaturated with acetic acid, &c., before testing for chlorates. Iodides should also be eliminated. Nitrates may be tested for by sulphuric acid and ferrous sulphate in the solution after the removal of the nitrites with ammonia and acetic acid. Thus the sulphuric acid solution of resorcinol, along with ferrous sulphate, permits of the detection of tartrates, nitrites, nitrates, and chlorates in the same solution. D. A. L.

Estimation of Oxygen in Commercial Copper. By BERTRAM BLOUNT (*Analyst*, **21**, 57—61).—The oxygen in metallic copper is generally assumed to be in the state of dissolved cuprous oxide, but a considerable fraction may be present in other forms, such as lead oxide, lead arsenate, &c.

After many trials, the author thinks that the best process for estimating this impurity is to fuse the sample in a current of pure hydrogen and weigh the water produced. The hydrogen is evolved from zinc and sulphuric acid, and, after passing through a washbottle containing solution of copper sulphate, it is freed from moisture by means of a sulphuric acid drying tube. To remove traces of oxygen, the gas is then passed through a bulb-tube of platinised asbestos, gently heated, and any moisture is then again absorbed in a second sulphuric acid tube (calcium chloride should not be used). The gas then enters a porcelain tube, inside which is placed a porcelain boat containing 10 to 15 grams of the sample, which is gradually heated by means of a small injector furnace until the metal is perfectly melted.

The water formed in this operation is absorbed in a weighed sulphuric acid tube, protected by a sulphuric acid guard-tube. After the hydrogen has passed for another five minutes, the tube is disconnected, the hydrogen is displaced by a current of dry air, and the tube is reweighed. L. DE K.

Influence of Sulphurous Anhydride in Coal Gas Flames on Quantitative Estimations. By EDUARD MULDER (*Rec. Trav. Chim.*, 1895, **14**, 307—316).—The author has made experiments to determine what effect, if any, the sulphurous anhydride of coal-gas flames has on various estimations. He comes to the conclusion that the estimation of barium as barium carbonate is not affected to any appreciable extent in working at fairly high temperatures with a platinum crucible which is kept covered. In the actual experiments, the calcined residue, when treated with hydrochloric acid, gave traces of barium sulphate, but these were too small to determine accurately.

By supporting the crucible in a hole made in an asbestos plate, the author finds that he can heat the crucible at a fairly high temperature without a lid, and that no sulphurous anhydride will be absorbed. A porcelain crucible may also be substituted for the platinum one. At extremely high temperatures, the platinum becomes porous to sulphurous anhydride, and a small quantity of the barium carbonate is decomposed into the oxide and carbonic anhydride, the former attacking the platinum.

In many estimations, better results are obtained by heating at a moderate temperature for a long time, rather than at a high temperature for a short time. J. J. S.

Estimation of Selenious and Selenic acids. By FRANK A. GOOCH and A. W. PEIRCE (*Zeit. anorg. Chem.*, 1896, **11**, 249—253; *Amer. J. Sci.*, [4], **1**, 31—34).—In the estimation of selenious acid by distilling it with potassium iodide and an acid, according to the method previously described by Gooch and Reynolds (this vol., ii, 124), a small quantity of iodine always remains in the distillation flask, and this necessitates two titrations of the iodine. To avoid this double titration, the authors proceed as follows. The selenious acid is mixed with a measured quantity of a concentrated solution of potassium iodide which has been standardised against arsenic acid, a solution of acid potassium arsenate and dilute sulphuric acid is then added, and the mixture distilled, as previously described. The residue in the distillation flask is neutralised with potassium hydroxide, and an excess of a concentrated solution of potassium hydrogen carbonate added. It is then titrated with normal iodine solution. This gives the quantity of iodine equivalent to the arsenious acid, that is, the amount of iodine liberated by the arsenic acid; the difference between this and the amount of iodine originally present as potassium iodide gives the amount of iodine liberated by the selenious acid. The results obtained are accurate.

When selenic acid is to be estimated, it is first reduced to selenious acid by boiling with potassium bromide and sulphuric acid, and then the selenious acid is estimated, as described above. E. C. R.

Estimation of Phosphoric acid in Soils by Precipitation with Molybdic Solution, and Titration of the Ammonium Phosphomolybdate. By C. B. WILLIAMS (*J. Amer. Chem. Soc.*, 1895, **17**, 925—926).—The author recommends the following process, the hydrochloric acid extract of the soil is obtained by digesting the sample in acid of 1·115 sp. gr. at 100° for 10 hours, the organic acid (1 per cent. citric acid and 0·63 per cent. oxalic acid solution) extracts being obtained by digesting at ordinary temperature for five hours. To destroy all organic matter in the first extract, an aliquot part is mixed with one-third of its volume of nitric acid and evaporated until only 2—3 c.c. is left; in the second case, the liquid is evaporated to dryness and ignited with the addition of nitric acid until the organic matter is completely destroyed.

The residues are now dissolved and made up to convenient volumes, and portions corresponding with 2—20 grams of soil (according to the supposed richness in phosphoric acid) are first mixed with 15 grams of ammonium nitrate, and, after heating to 40°, precipitated with 30 c.c. of the conventional molybdate solution. After four hours, the precipitate is collected and twice washed with water; it is now dissolved in dilute ammonia, and nitric acid is added until the precipitate begins to re-form; 10 grams of ammonium nitrate is added, also 2 c.c. of nitric acid, and, after five minutes, 2 c.c. of molybdate solution. The now very pure molybdate precipitate is collected and titrated according to the author's process. L. DE K.

Estimation of Phosphoric acid by the Molybdate-Magnesia Method, and by a Volumetric Method. By B. W. KILGORE (*J. Amer. Chem. Soc.*, 1895, **17**, 941—943).—The author has again submitted solutions of disodium hydrogen phosphate of known strength to a number of analysts, with the request to estimate the phosphoric by the molybdate-magnesia method and by the (American) volumetric process.

On the whole, the volumetric estimations were the best, the gravimetric ones being in many instances considerably in excess of the truth. L. DE K.

Estimation of Phosphoric acid by Titration of the Ammonium Phosphomolybdate Precipitate with Standard Alkali. By B. W. KILGORE (*J. Amer. Chem. Soc.*, 1895, **17**, 950—968).—If the sample contains much organic matter, 2 grams is ignited with magnesium nitrate, and then dissolved in hydrochloric acid. Ordinary phosphates and fertilisers are dissolved in 30 c.c. of strong nitric acid containing a little hydrochloric acid, or in 30 c.c. of warm hydrochloric acid with gradual addition of 0·5 gram of potassium chlorate. Phosphates rich in iron or aluminium are dissolved in 15—30 c.c. of hydrochloric acid, and 5—10 c.c. of nitric acid. The solution is made up to, say, 200 c.c., and a suitable portion is taken for analysis.

After adding about 5 or 10 c.c. of nitric acid, ammonia is added, until a precipitate just begins to form, and the liquid is diluted to 60 or 100 c.c., and then, after heating to 65°, precipitated with a slight excess of filtered molybdate solution (100 grams of molybdic acid, 400 grams of ammonia, sp.gr. 0·96, 1500 grams of nitric acid, sp. gr. 1·2, and 80 c.c. of nitric acid, sp. gr. 1·42). After six minutes, or, if the sample is very poor, eight or ten minutes, the liquid is filtered as quickly as possible through a 3-in. Hirsch funnel, the perforations of which are covered with a disc of soft filter-paper, or in a Gooch crucible, with one or two pieces of filter-paper slightly larger than the bottom of the crucible, using the filter pump in both cases. The precipitate is twice washed by decantation, using 50—75 c.c. of dilute nitric acid (1—10, of 1·42 sp. gr.), then once with the same amount of 3 per cent. solution of ammonium nitrate, and finally washed on the filter, until the washings are no longer acid; this generally requires 250 c.c. of water.

The precipitate is now rinsed back into the beaker and dissolved in a known amount of standard potash, the excess of which is titrated back with standard nitric acid, using phenolphthaleïn as indicator.

If the alkali contains exactly 18·17106 grams of potassium hydroxide per litre, 1 c.c. equals 0·001 gram of P_2O_5. L. DE K.

Gravimetric Method of Estimating Phosphoric acid as Ammonium Phosphomolybdate. By THOMAS S. GLADDING (*J. Amer. Chem. Soc.*, 1896, **18**, 23—27).—The direct weighing of the yellow precipitate has often been attempted, with but indifferent success. The author has succeeded in obtaining a precipitate which, after drying at 105°, contains exactly 3·76 per cent. of phosphoric anhydride.

The solution of the phosphate is mixed with an equal bulk of strong ammonia, and strong nitric acid is then added to acidity. The solution is now heated in a water bath to 50°; the conventional 10 per cent. solution of molybdate is added from a burette with constant stirring, 50 c.c. being added in five minutes. After about 10 c.c. in excess has been added, the heating is continued for 10 minutes, and the precipitate is collected on a weighed filter. It is advisable to test the filtrate with some more of the reagent, to make sure of the complete absence of phosphoric acid. The precipitate is washed first with water containing 1 per cent. of nitric acid, and finally once with distilled water. After removing the excess of moisture by means of blotting-paper, the filter is dried at 105° to constant weight. The process may also be used in presence of ammonium citrate, but the liquid should then be first largely diluted, and heated for 40 minutes at 65°. L. DE K.

Three new Reagents for Nitrites. By GEORGES DENIGÈS (*J. Pharm.*, 1895, [6], 2, 289—293).—The first of these gives a reaction characteristic for nitrites, and is a modification of Millon's reagent; two solutions are employed. (A) 1 gram of pure white phenol is agitated with 4 c.c. of sulphuric acid and 100 c.c. of water. (B) Either 5 grams of pulverised mercuric acetate (or 3·5 grams of mercuric oxide and 20 c.c. of glacial acetic acid) and 100 c.c. of water, are mixed, shaken some minutes, treated with 0·5 c.c. of sulphuric acid, and filtered. A solution of acid mercuric sulphate may be used instead of B. Equal volumes of the two solutions are mixed, heated to boiling, and the solution, or potable water to be tested, added; when as much as 5 parts per 10,000 of nitrite is present, a red or pink coloration is obtained immediately with a drop or two in 4 c.c. of the mixed reagents; with more dilute solutions, 1 to 10 c.c. is required, and the boiling must be repeated; in this way 10 c.c. of a solution containing 2 per million of nitrite will yield a pink coloration in 4 c.c. of the mixed reagents; whilst with 10 c.c. of each reagent and 100 c.c. of water, and boiling for two or three minutes, 2 parts per ten million of nitrite can be detected. The solutions are colourless, stable, and are not affected by light, air, or oxidising agents; moreover, with the more dilute solution, the intensity of coloration is proportional to the quantity of nitrite present, and the tests may consequently be made quantitative.

The second reagent consists of 2 c.c. of aniline and 40 c.c. of glacial acetic acid, made up to 100 c.c. with water, boiled to destroy any coloration, and then stored in a yellow or black glass bottle to keep it colourless. 5 c.c. is boiled with a drop to 10 c.c. of the suspected liquid, and gives a straw yellow to deep orange coloration, according as the quantity of nitrite present is small or great. The coloration is changed to red by hydrochloric or sulphuric acid, but is restored by neutralising with soda or sodium acetate. The red coloration is more delicate than the yellow, and as little as 2 parts per ten million of nitrous acid can be detected by using 50 c.c. of reagent to 100 c.c. of a potable water, boiling three or four minutes, and acidifying with sulphuric acid. Acid solutions should be neutralised with an alkaline hydroxide or carbonate before adding the aniline acetate. This reagent is affected by hypochlorites, hypobromites, and free chlorine and bromine, but not by chlorates or nitrates; it serves for the detection of nitrites in the presence of iodides, and for the ready determination of the former volumetrically.

The third reagent is the solution of resorcinol, which the author has suggested for the detection of tartaric acid (this vol., ii, 80); it contains 1 gram of pure white resorcinol, 100 c.c. of water, and 10 drops of sulphuric acid. By agitating 5 drops of this reagent with 2 c.c. of pure sulphuric acid and 4 drops of the solution under examination, an intense reddish carmine or violet-blue coloration is produced, without heating, even when only 0·00001 gram of nitrous acid is present per litre. This reagent is coloured green by chlorates.

D. A. L.

Estimation of Boric acid. By LEONCE BARTHE (*J. Pharm.*, 1895, [6], **2**, 345—347).—Volumetric estimations of boric acid under the ordinary circumstances with the usual indicators are unsatisfactory; the author finds that in the presence of glycerol, and by the use of extract of hollyhock and phenolphthaleïn as indicators, the alkali and the boric acid of alkali borates can be titrated separately; with boric acid only in solution the matter is simplified, for, after adding glycerol and water, N/10 potash is used with these indicators. The tincture or extract of hollyhock is prepared as required by macerating the petals for some minutes; its reddish colour is turned bright red by acids, and green by alkalis; the latter change is very sharp, and alone is used in the method, which is best conducted in very dilute solutions. The results of Jay and Dupasquier (this vol., ii, 76) are criticised.

D. A. L.

Estimation of Carbonic Anhydride by Absorption. By HEINRICH HEIDENHAIN (*J. Amer. Chem. Soc.*, 1896, **18**, 1—7).—The apparatus consists of an eprouvette filled with soda-lime with a little cotton-wool at the top, a cock to regulate the air current, and a capillary tube to offer resistance to the air in case the cock is opened too far. The air then passes through a funnel tube closed at the bottom by a perforated rubber stopper, into which the glass tube conveying the air is fitted. This arrangement in connection with the cock is a substitute for a three-way cock, but has the advantage that the regulating part does not get wet and is not exposed to heat. The funnel is filled with dilute acid, and its tube reaches to the bottom of a 300 c.c. evolution flask, which contains the weighed carbonate, and is heated by a small burner. To prevent undue accumulation of water vapour, the steam is condensed by passing through an upward bent tube, around which a lead pipe conveying water is wound, which causes the steam to condense and run back into the flask. The gas then passes through a calcium chloride tube, then through a layer of pumice stone moistened with copper sulphate and then again through calcium chloride. The absorption tubes consist of two stoppered U-tubes containing soda-lime. The first tube contains a little calcium chloride at the end where the air enters, but the second tube is filled half with soda-lime and half with calcium chloride where the air leaves it.

The air is drawn by an aspirator, and a safety bottle and a guard tube containing soda-lime and calcium chloride prevent any moisture or carbonic anhydride from re-entering. L. DE K.

Estimation and Separation of Copper. By F. MAWROW and WILHELM MUTHMANN (*Zeit. anorg. Chem.*, 1896, ii, 268—271).—When a solution of copper sulphate is treated with hypophosphorous acid at 60°, a yellowish-red precipitate of copper hydride is obtained, which, when heated at a higher temperature, is decomposed with formation of copper and hydrogen. This reaction is employed for the estimation of copper; the copper salt, previously converted into sulphate, is boiled with hypophosphorous acid as long as hydrogen is evolved, and the precipitated metal, which is extremely easy to collect, is washed with boiling water, alcohol, and ether, dried at 100°, and weighed. The results are very accurate. The nitrate or acetate can also be employed: but the solution must be free from chloride, as in this case cuprous chloride is formed, which is not further reduced by the hypophosphorous acid.

The method is especially applicable to the separation of copper from cadmium or zinc. The copper precipitate, which is quite free from cadmium or zinc, is filtered off and weighed as above, and the cadmium or zinc precipitated as sulphide from the filtrate.

Hypophosphorous acid is easily prepared by the action of phosphorous on barium hydroxide, and decomposition of the barium hypophosphite with sulphuric acid. E. C. R.

Electrolytic Method for Estimating Mercury in Cinnabar. By W. B. RISING and VICTOR LENHER (*J. Amer. Chem. Soc.*, 1896, **18**, 96—98).—The authors dissolve the finely powdered mineral in dilute hydrobromic acid (1 part of 49 per cent. acid and 4 parts of water). The slight excess of acid is neutralised with aqueous potash, and after adding excess of potassium cyanide, the solution is electrolysed by a current giving 0·025 ampère, $N.D._{100}$.

The hydrobromic acid is easily prepared by heating potassium bromide with sulphuric acid of 1·636 sp. gr., and passing the gas into water. On account of the low temperature at which it decomposes cinnabar, no loss by volatilisation of mercury takes place.

L. DE K.

Analysis of Aluminium and its Alloys. By HENRI MOISSAN (*Compt. rend.*, 1895, **121**, 851—856).—In the absence of copper, about 3 grams of metal are dissolved in dilute hydrochloric acid, any insoluble residue being decomposed by means of fused sodium carbonate, dissolved in acid, and mixed with the rest of the liquid, which is then evaporated to dryness, and dried at 125° until hydrogen chloride is no longer given off. The silica is estimated in the usual way; the solution is diluted to 500 c.c., and in 25 c.c. of this, the iron and aluminium are precipitated by ammonium sulphide in presence of a somewhat large quantity of ammonium salts and very little ammonia, and weighed as oxides. In order to estimate the iron, 250 c.c. of the filtrate from the silica is concentrated to about 100 c.c., and precipitated with excess of potassium hydroxide free from silica, the washed precipitate being redissolved in hydrochloric acid, and reprecipitated.

The estimation of sodium is based on the fact that aluminium nitrate is decomposed at a temperature at which sodium nitrate undergoes no change. 5 grams of aluminium is dissolved in nitric acid diluted with its own volume of water, care being taken that the temperature does not rise too high; after evaporation to dryness, the residue is heated at a temperature below the melting point of sodium nitrate until nitrogen oxides are no longer given off. The residue is extracted with water, and the solution slightly acidified with nitric acid and evaporated to dryness, the second residue extracted repeatedly with boiling water, the solution evaporated to dryness, redissolved, filtered, the sodium nitrate converted into chloride, and the chlorine estimated after drying at 300°.

Carbon is estimated by triturating 2 grams of the metal with 10 to 15 grams of mercuric chloride and a small quantity of water, evaporating the mixture on a water bath, and heating the residue in a current of pure hydrogen. The residue is then heated to redness in a current of oxygen, and the carbonic anhydride collected and weighed in the usual manner.

If the alloy contains copper up to about 6 per cent., 0·5 gram is dissolved in nitric acid free from chlorine, diluted to 50 c.c., and the copper deposited by electrolysis with a current of about 0·1 ampère, the process requiring about six hours at 60°, and 24 hours at the ordinary temperature. After removal of the copper, the aluminium, iron, and silicon are estimated in the manner already described.

A sample of aluminium from Pittsburg had the composition Al, 98·82; Fe, 0·27; Si, 0·15; Cu, 0·35; Na, 0·10; C, 0·41; N, traces; Ti, traces; S, absent, = 100·10. During the last few years, great progress has been made in the preparation of pure aluminium on a large scale. The industrial value of the metal cannot, however, be deduced from its composition alone, but physical tests must also be made. C. H. B.

Volumetric Estimation of Manganese. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1895, **17**, 943—947).—The author uses Volhard's process for estimating manganese in samples of steel, but in order to get trustworthy results, the following details should be adhered to.

3·3 grams of the sample is dissolved in a covered evaporating dish in 40 c.c. of 50 per cent. nitric acid, and 8 c.c. of strong sulphuric acid is then added. If, on evaporating, there is a tendency to bumping or spattering, some hydrochloric acid should be added. When the mass becomes pasty and nearly dry, it is allowed to slightly cool, and is then boiled with water for a few minutes. When cold, the liquid is introduced into a 500 c.c. flask, nearly neutralised with sodium carbonate, and the iron precipitated by adding a sufficiency of emulsion of zinc oxide. After diluting to the mark and filtering, 250 c.c. of the filtrate is boiled in a 500 c.c. Erlenmeyer flask and titrated with standard permanganate (strength, 0·0055) until the supernatant liquid turns a rose colour no longer changing to yellow after shaking well. If the percentage of manganese is approxmately known, it is better to add the greater part of the permanganate at once.

The number of c.c. of permanganate, divided by 10, equals the percentage of manganese in the sample. L. DE K.

Detection of Chromates and Arsenites. By N. TARUGI (*Gazetta*, 1895, **25**, ii, 248—251).—If a chromate and an arsenite are present together in a solution, usually only one of them is found in the liquid after boiling with sodium carbonate to remove the bases; this is owing to the formation of insoluble chromium arsenate. If the solution is heated for a short time only with sodium carbonate, both acids may be detected in the filtrate by adding silver nitrate after acidifying, as the precipitation of the chromium arsenate is not instantaneous. W. J. P.

Niobium and Tantalum. By MARY ENGLE PENNINGTON (*J. Amer. Chem. Soc.*, 1896, **18**, 38—67).—See this vol., ii, 305.

Estimation of Nitrites in Potable Waters. By AUGUSTUS H. GILL and HERBERT A. RICHARDSON (*J. Amer. Chem. Soc.*, 1896, **18**, 21—23).—When testing peaty waters by Trommsdorff's iodo-zinc starch test, or by Griess' α-naphthylamine reaction, it is necessary to first remove the peaty matter, as this greatly interferes with the delicacy of these tests. For this purpose the authors recommend shaking 250 c.c. of the sample with 3 c.c. of an emulsion of alumina and filtering through a well-washed filter.

The reagents must, of course, be dissolved in water absolutely free from nitrites. This is best prepared by distilling water with alkaline permanganate, and collecting the middle portion only.

L. DE K.

The Colouring Matter of Natural Waters. Its Source, Composition, and Estimation. By ELLEN H. RICHARDS and J. W. ELLMS (*J. Amer. Chem. Soc.*, 1896, **18**, 68—81).—The colouring matter of surface waters is derived from decaying leaves and consists of several complex substances such as tannins, glucosides, and their derivatives, &c. Iron, although generally present in very small quantity, is not an essential constituent. Some of the components are no doubt nitrogenous, as highly-coloured waters generally yield an abundance of albuminoïd ammonia, but a large diminution of nitrogen does not cause a corresponding decrease in colour.

The actual amount of organic colouring matter cannot be estimated with anything like accuracy, but the authors have found that it is comparatively easy to estimate the relative proportion of colouring matter in different samples. The nature of the colouring being practically the same, the relative amount may be ascertained colorimetrically. The standard sample is prepared by diluting a highly coloured water with distilled water, and comparing this with the colour produced by Nessler's reagent in a solution of ammonia of known strength. The standard water keeps fairly well for about six months, if sterilised at first. The colorimeter used by the authors is the well-known Lovibond's tintometer. L. DE K.

Microscopical Examination of Water. By WILLIAM J. DIBDIN (*Analyst*, **21**, 2—5).—One litre (or less) of the sample is measured in a flask with a long narrow neck, which is then inverted over a funnel containing a hardened filter 3 in. in diameter. The mouth of the flask should be just inside the filter. When all the liquid has passed through, the deposit is rinsed by means of a jet of pure distilled water into the micro-filter.

This is made from a perfectly clean piece of combustion tube about 10 in. long by drawing it out in the middle to a capillary tube, the narrowest part of which should be something less than 2 mm. in diameter. It is cut with a file at the point at which the tube is exactly 2 mm. It is then made into a filter by charging the small end with a suitable porous medium prepared by mixing equal parts of powdered air-dried clay and *Kieselghur*, moistening, and working to a smooth paste. When the capillary tube is charged, the mixture is warmed and gradually heated to redness in a gas flame.

The liquid containing the deposit soon filters through the plug (in obstinate cases suction must be resorted to), and when only about ½ in. of water remains, the height of the column of suspended matter is ascertained and recorded. After cutting off the capillary tube, the deposit may be easily loosened by touching it with a platinum wire, and it may then be subjected to a careful microscopical examination. By this method of manipulation, the author has found objectionable matter in samples of water which had been reported to be free from deposit. An exhaustive table is given. L. DE K.

Estimation of Methane and Hydrogen by Explosion. By AUGUSTUS H. GILL and SAMUEL P. HUNT (*J. Amer. Chem. Soc.*, 1895. **17**, 986—994).—The authors have thoroughly investigated the conditions necessary for the success of the explosion process.

It appears that the idea that pure methane may be readily prepared by heating sodium acetate with soda-lime is erroneous, as the gas thus obtained sometimes contains 10 per cent. of free hydrogen.

The method by one explosion is fairly accurate for the hydrogen, but as regards the methane the method by two successive explosions should be used.

When a mixture of hydrogen and methane is exploded with a quantity of oxygen insufficient for both, but more than sufficient for either, about 60 per cent. of the hydrogen, 25 per cent. of the methane and 50 per cent. of the oxygen is consumed.

L. DE. K.

Effect of adding Alum to Wine. By Fausto Sestini (*Gazzetta*, 1895, **25**, ii, 257—263).—The practice of adding small quantities of alum to wine is found to cause a gradual deposition, which consists principally of calcium phosphate; wine to which alum has been added would therefore not contain a high percentage of aluminium or phosphoric acid, but a relatively large proportion of sulphates. The custom of adding alum to wine is consequently injurious.

W. J. P.

Analyses of Fruit Sugars, Syrups, and Preserves. By Py (*J. Pharm.*, 1895, [6], **2**, 488—491).—Polarising before and after inversion, as also the Fehling test, show that sugars from currants, cherries, and strawberries are similar to mixtures of 92 per cent. of saccharose with not more than 8 per cent. of glucose. Syrups contain about 60 per cent. of total sugar, of which about 4·8, at the highest, is due to fruit sugar, so that the amount of glucose present if the syrup or preserve is made with saccharose is negligable, and the purity of such syrup or preserve can be ascertained by making one Fehling test and one polariscopic examination. These are made in solutions containing 25 grams of the syrup or preserve in 100 c.c., decolorised by lead subacetate, and inverted by 10 per cent. hydrochloric acid. The saccharometric deviation at 17° should be within a few degrees of that indicated by multiplying the weight of the reducing sugars by 2·066; if otherwise, glucose must be sought in the usual way. Instead of the Fehling test, &c., a polariscope reading may be taken before and after inversion; if the rotation is still to the right in the latter case, there is no doubt that glucose is present, except in the case of plums. In fact, as much as 29 per cent. of glucose may be present and the rotation still be slightly to the left, therefore the two polarisings should not alone be depended on when the deviations are not well marked. Artificial fruit syrups consist of pure sugar, little or no fruit sugar, colouring matter, citric or tartaric acid; they should be tested for the colouring matter, the absence of fruit sugar ascertained, &c. Gelose can be detected in preserves by searching for diatoms, for example, *Grammatophora marina*, as well as by the presence of *Arachnoïdiscus japonicus*. D. A. L.

Estimation of Levulose in Honeys and other Substances. By Harvey W. Wiley (*J. Amer. Chem. Soc.*, 1896, **18**, 81—90).—The process is based on the fact that the optical rotation of levulose is strongly diminished at an increased temperature, whilst the accompanying substances are scarcely affected. The most important part of the apparatus is a jacketed observation tube, which may be cooled to zero or heated to 88°, at which temperature a mixture of equal molecules of levulose and dextrose is optically inactive. In every case, the sugar solutions are made to standard volume at the temperatures at which they are to be read, thus avoiding variations due to expansion or contraction. In all cases, the observation tube should be left for at least half an hour in contact with the temperature controlling medium before the reading is made. Any variation in temperature produces a distortion of the field of vision, whilst a constant fixed temperature will disclose it in its true shape and distinctness of outline. The strength of the sugar solution should be 26·048 grams of solid matter in 100 c.c. of liquid.

If K represents the deviation in divisions of cane sugar scale or in angular rotation produced by 1 gram of levulose for 1° temperature, T and t' the temperatures at which the observations are made, R the observed deviation in rotation, W the weight of levulose obtained, and L the percentage of levulose required, then

$$L = \frac{R}{K(T - t')} \div W.$$

L. DE K.

Estimation of the Extract of Malt in the Laboratory. By JOHN HERON (*J. Fed. Inst. Brewing*, 1895, **1**, 116—118).—The author finds that the method described by him in 1888 (*J. Soc. Chem. Ind.*, **7**, 267), although satisfactory for normal malts, yields results which are too low in the case of hard, steely malts. He therefore recommends that two determinations be made, one under the ordinary conditions and the other under conditions which yield what he terms the "highest available extract," and the nearer the results of the two methods approach one another the better is the quality of the malt under examination. The new method is carried out as follows:—50 grams of the malt, ground as fine as possible, is transferred to a 500-c.c. flask or beaker, and 400 c.c. of water at 55° added, giving an initial heat of 50°. The mash is carried on for an hour in a water bath, the temperature being gradually raised to 70°. It is then quickly raised to 88°, maintained at this temperature for 15 minutes and then cooled to 15·5°, made up to 515 c.c., filtered, and the extract determined in the usual way. A. K. M.

Estimation of Uric acid in Urine. By GOTTFRIED VON RITTER (*Zeit. physiol. Chem.*, 1895, **21**, 288—296).—The method investigated is that of Hopkins (Abstr., 1893, ii, 395), and, as further modified by that author, is stated to give good results. The urine is saturated with ammonium chloride; the precipitate of ammonium urate is washed, dissolved in concentrated sulphuric acid, and titrated with permanganate direct.

The paper is mainly concerned with details of manipulation.

W. D. H.

Composition and Analysis of Condensed Milk. By THOMAS HAMES PEARMAIN and CRESACRE GEORGE MOOR (*Analyst*, **20**, 268—272).—The authors have analysed 50 brands of commercial condensed milk, and tabulated the results.

The analytical process used is as follows: 10 grams of the sample is diluted to 100 c.c.; 20 c.c. is evaporated in a platinum dish until the weight is constant, and finally burnt to ash. The proteïds are estimated by evaporating 10 c.c. to dryness in a flask, and then treating by Kjeldahl's process. The milk sugar is estimated by diluting 10 c.c. with 50 c.c. of ammonia and 40 c.c. of water, and then using Pavy's process. The fat is estimated by applying Adam's paper process, working on 5 c.c. in duplicate. The fat may also be estimated by means of the Leffmann-Beam machine; but as it is necessary to dilute largely, the results are only approximate. L. DE K

Iodine Number of Lard. By LEOPOLD VAN ITALLIE (*Ned. Tydschr. Pharm., &c.*, 1895, **7**, 294—295).—The author has determined the iodine absorption of lards which he had himself prepared during a period of 12 months.

It appears that the iodine number is not influenced by the season; also that a sample, giving a figure slightly below 49, may still be genuine. L. DE K.

Van de Moer's Reaction and the Detection of Cytisine. By K. GORTER (*Ned. Tydschr. Pharm., &c.*, 1895, **7**, 234—240, and *Arch. Pharm.*, 1895, **233**, 527—533).—Van de Moer was the first to suggest a delicate test for this alkaloïd (Abstr., 1891, 946); it consists in moistening the substance with ferric chloride and then with hydrogen peroxide; the red colour first disappears, but, on gently warming, a permanent blue coloration is developed; 0·05 milligram of the alkaloïd may thus be detected.

The colour disappears on adding ammonia, but reappears on adding an acid. It has been stated that after the addition of soda the coloration does not return on acidifying; this, however, the author finds to be erroneous, as the colour, when discharged by aqueous soda or lime water, is completely restored by adding an acid.

The reaction is most delicate when the amount of iron present amounts to about half the weight of the cytisine, and it is probably owing to their having used too much ferric chloride solution that the test was condemned by Magelhaes and Partheil. The reaction recommended by these authors was warming the alkaloïd with strong sulphuric acid and thymol, which causes first a yellow, then a red, and finally a claret-like colour. The author, however, states that this reaction is always given even in the complete absence of cytisine. L. DE K.

Detection of Strychnine in a Medico-Legal Case. By MANKIEWICZ (*Arch. Pharm.*, 1895, **233**, 508—511).—An account of a controversy arising from the accumulation of the alkaloïd in certain organs only of an exhumed body. JN. W.

A Delicate Test for Albumin in Urine. By ADOLF JOLLES (*Zeit. physiol. Chem.*, 1895, **21**, 306—310).—Acetic acid and potassium ferrocyanide will detect 1 part of albumin in 70,000 of urine. Its disadvantage is the production of an intense yellow colour due to nitrites in the urine (Karplus, *Centr. Klin. Med.*, **14**, 577). Spiegler's reagent (*Wien. Klin. Woch.*, 1892, No. 2) is not so sensitive, and its delicacy is diminished by a diminution of the urinary chlorides such as occurs in many diseases. The following reagent is recommended as the best, and it will detect the minutest traces (1 in 120,000) of albumin: mercuric chloride, 10, succinic acid, 20, sodium chloride, 10, water, 500 parts. Four or five c.c. of filtered urine are acidified with 1 c.c. of 30 per cent. acetic acid, and 4 c.c. of the reagent added; on shaking, if albumin is present, a precipitate occurs; a comparative test is made at the same time with 4—5 c.c. of the urine and 1 c.c. of acetic acid. W. D. H.

General and Physical Chemistry.

The Influence of Electrolytic Dissociation, &c., on the Molecular Refraction. By MAX LE BLANC and P. ROHLAND (*Zeit. physikal. Chem.*, 1896, **19**, 261—286).—In order to determine whether the hydrogen ion has a greater specific refraction than that of the combined atom, the authors determined the difference between the molecular refractions of (1) weakly dissociated, (2) strongly dissociated, acids and their sodium salts, which are in all cases strongly dissociated. In the case of formic, acetic, glycollic, propionic, butyric, glyceric, and lactic acids, the difference in the molecular refractions varied between 3·08 and 3·72 (Gladstone), between 1·56 and 1·80 (Lorenz). For the more strongly dissociated acids, mono-, di-, and tri-chloracetic, nitric, and hydrochloric acids, the differences were 3·17 to 1·37 and 1·60 to 0·75, the number decreasing with dilution and dissociation, so that the hydrogen ion exerts a greater influence than the acid ion. The refraction of sulphuric and tartaric acids were found by Hallwachs to remain almost constant on dilution, a result probably due to the influence of the other ions. Experiments with bases were undertaken, but no similar conclusion regarding the hydroxyl ions could be established. Assuming the acid ion to have the same equivalent refraction as in combination, and the hydrogen to have the atomic refraction 1·05, the values for sodium and chlorine were found to be 2·69 and 6·61. The latter agrees well with the value 6·42, which is independently obtained from the differences between the bases and chlorides. The refractions of salts in the solid state and in solution were also compared, that of the solution being usually greater, but in both cases the molecular refraction appears approximately additive. The experiments with various solvents indicate also a specific influence of the solvent.

L. M. J.

Absorption Spectra of some Chromothiocyanates. By GAETANO MAGNANINI (*Gazzetta*, 1895, **25**, ii, 373—379).—A study of the absorption spectra of some of the chromothiocyanates leads to results similar to those obtained by Magnanini and Bentivoglio (Abstr., 1894, ii, 129) with the blue chromoxalates.

Cryoscopic and electrical conductivity determinations indicate that potassium chromothiocyanate is not a true double salt, but one which dissociates in aqueous solution into the ions K_3 and $Cr(CNS)_6$. A comparison of the photographed absorption spectra of three aqueous solutions containing gram molecules per litre of $K_3Cr(CNS)_6$, $Na_3Cr(CNS)_6$, and $Na_3Cr(CNS)_6 + 2NaNO_3$, shows that notwithstanding the diminution of the dissociation of the sodium salt brought about by adding sodium nitrate, the absorption spectra are identical.

W. J. P.

Absorption of Light by Solutions of Indophenols. By PIERRE H. BAYRAC and CH. CAMICHEL (*Compt. rend.*, 1896, **122**, 193—195).—Indophenols, although derived from phenols differing considerably in composition, all show similar absorption spectra. The colour of the solution varies with the nature of the solvent, and the same solvent gives the same coloured solutions with different indophenols. The spectrum consists of a somewhat narrow, brilliant red band, and a broad and somewhat feeble green-blue and violet band, all the other rays being absorbed. As the concentration of the solution or the thickness of the absorbing layer increases, the middle of the red band seems to be displaced towards the blue end of the spectrum and *vice versâ.* Notwithstanding the differences in the colours of the solutions, all the spectra are analogous, the differences being due to differences in the relative absorptions of the more refrangible and less refrangible halves of the spectrum.

Quantitative observations show that when equal volumes of the same solvent contain quantities of the indophenols proportional to their molecular weights, the red band occupies the same position in the various spectra.

It would seem that an examination of the character of the absorption spectrum may help to determine whether a particular substance is really an indophenol or not. C. H. B.

Fluorescence of Sodium and Potassium Vapour, and its Importance in Astrophysics. By EILHARD WIEDEMANN and GERHARD C. SCHMIDT (*Ann. Phys. Chem.*, 1896, [2], **57**, 447—453).—The authors find that both sodium and potassium vapour have a marked fluorescence, the first green, and the second red. The fluorescence spectrum of sodium vapour is composed of three parts, a continuous band in the red, a channeled band in the green, and the yellow sodium line. The fluorescence spectrum of potassium vapour consists of a red band, 695—615. The spectra which these vapours yield under the influence of electrical discharges appear to correspond to the fluorescence spectra, and Stokes' rule holds for these as for other cases of fluorescence. The authors point out that the establishment of fluorescence for the vapours of the metals would throw light on some hitherto unexplained astrophysical phenomena. H. C.

Specific Rotation of α-Nitrocamphor in Various Solvents. By MOSÈ PESCETTA (*Gazzetta*, 1895, **25**, ii, 418—423).—Cazeneuve and van't Hoff have both remarked the extent to which the specific rotation of α-nitrocamphor is affected by variations in concentration and difference of solvent; the author has therefore determined the specific rotation of this substance in benzene and alcoholic solutions for the five wave-lengths given by the Landolt ray-filters.

The specific rotations $[\alpha]$ in a 1·064 per cent. benzene solution are −65·45°, −93·6°, −131·98°, −182·0°, and −294·3°, and for a 3·562 per cent. alcoholic solution +2·64°, −2·30°, −13·11°, and −24·16° at 20° for the rays "red," D, "green," "light blue," and "dark blue" respectively (dark blue not given for alcoholic solution). A 1·2108 per cent. alcoholic solution at 20° is inactive to the ray "red," whilst a 10·754 per cent. solution is inactive to D. The dispersion coefficients are constant for the various concentrations in benzene solution. Both alcoholic and benzene solutions become more positive in specific rotation as the concentration increases.

The freezing point depressions of benzene and the rise in boiling point of alcohol caused by α-nitrocamphor are normal.

W. J. P.

Multirotation of Reducing Sugars and of Isodulcitol. By Charles Tanret (*Compt. rend.*, 1896, **122**, 86—87).—See this vol., i, 334).

Acetylene as a Photometric Unit. By Jules Violle (*Compt. rend.*, 1896, **122**, 79—80).—When acetylene is burnt under a somewhat high pressure in a burner which produces a broad, thin flame, a very brilliant and remarkably white light, of constant intensity, is obtained, the illuminating power being practically uniform over a large area. By placing in front of the flame a screen pierced with an aperture or apertures of definite dimensions, very convenient photometric units can be obtained. The intensity of the flame is about 20 times that of the flame from an equal volume of coal gas burnt in an ordinary burner, and at least six times as great as that of the coal gas burnt in an incandescent burner.

In spectroscopic character, the light from the acetylene flame differs very little from that emitted by melting platinum. C. H. B.

Dark Radiations. By Gustave Le Bon (*Compt. rend.*, 1896, **122**, 188—190).—When an ordinary negative is placed in contact with a sensitive plate, and a thin sheet of iron is put in front of the negative, the whole being enclosed in a printing frame and exposed to the light from a petroleum lamp for about three hours, a faint but distinct image is obtained on the sensitive plate, after prolonged energetic development. If a sheet of lead is placed behind the sensitive plate and the edges are wrapped over so that they come in contact with the iron in the front, other conditions remaining the same, a vigorous image is obtained on development. It is possible that the two metals produce thermo-electric currents, which add their effects to those of the dark radiations. The observed effects are not due to any appreciable rise of temperature. Exposure to sunlight gives similar results, the solar rays not being appreciably more active than those from a lamp. Cardboard and metals, especially iron and copper, are easily traversed by the rays. When plates similarly protected are exposed in a camera, they blacken on development, but yield no distinct images. C. H. B.

Properties of Röntgen Rays. By Jean Perrin (*Compt. rend.*, 1896, **122**, 186—188).—Perrin has repeated some of Röntgen's experiments, and confirms his statements (1) that they produce developable images on ordinary photographic plates; (2) that they are not cathode rays; (3) that the opacity of the following substances to the rays increases from the beginning to the end of the list: carbon, bone, ivory, calcspar, glass, quartz, rock salt, sulphur, iron, steel, copper, brass, mercury, lead. Wood, paper, wax, paraffin, and water are very transparent; (4) that the propagation of the rays is rectilinear, but that they are not refrangible, are reflected only to a slight extent, and show no evidence of diffraction. C. H. B.

Discharge Phenomena in Rarefied Metallic Vapours. By EILHARD WIEDEMANN and GERHARD C. SCHMIDT (*Ann. Phys. Chem.*, 1896, [2], **57**, 454—458).—The authors show that rarefied metallic vapours contained in a heated glass vessel may be made to glow under the influence of oscillatory discharges. These vapours, even when the metal is known to be monatomic, then exhibit all the typical discharge phenomena, and the characteristic difference in the colour and spectrum of the anode and cathode discharge. The appearances observed with a number of the metals examined are described in the paper.

H. C.

Molecular Conductivity of Dilute Solutions. By NIKOLAI N. BEKETOFF (*J. Russ. Chem. Soc.*, 1894, **26**, 65—66).—The known fact that the molecular conductivity of a solution of an electrolyte increases with dilution is explained by the author by an ingenious modification of Grötthus' hypothesis. In the latter, the electrolysis of sodium chloride, for example, is supposed to proceed by the end-atom of sodium becoming detached and decomposing water to form sodium hydroxide, the end chlorine atom then uniting with the sodium of the next molecule, and so on to the other terminal, where the last chlorine atom is disengaged. This, however, does not explain the effect of dilution. The author's idea is that the intervening molecules of water take part more and more in the chain of reactions as the solution becomes more dilute, actually forming *free* sodium hydroxide and *free* hydrogen chloride in the intervals. As both caustic soda and free hydrogen chloride are better conductors than either sodium chloride or water, the rise of the mean molecular conductivity on dilution would be satisfactorily explained.

S. G. R.

Thermal Conductivity and Ion Velocity. By GEORG BREDIG (*Zeit. physikal. Chem.*, 1896, **19**, 228—232).—The results obtained by the author for the kathion velocity in the case of the amines (Abstr., 1894, ii, 226) are closely analogous to those obtained by Höfker (*Diss, Jena*, 1892) for the mean free path in these compounds in the gaseous state, the latter constant being obtained from measurements of the thermal conductivity of the gases. Both constants decrease with diminishing differences as the weight of the alkyl increases, and, in metameric amines, are greater the greater the number of alkyl groups united to the nitrogen. The author finds also that the thermal conductivity may be expressed as a linear function of the ion velocity, the observed and calculated numbers agreeing within the limits of experimental errors, as seen in the table, where the calculated values are obtained by the equation $K = 23{\cdot}4 + 0{\cdot}747\,\alpha$.

	Observed.	Calc.		Observed.	Calc.
Methylamine	66·4	66·5	Dimethylamine....	61·6	60·9
Ethylamine......	58·4	58·4	Diethylamine	52·6	50·4
Propylamine.....	52·6	53·4	Dipropylamine....	44·8	46·1
Butylamine......	52·2	50·6	Trimethylamine...	57·1	58·6
Amylamine......	49·0	48·8	Triethylamine.....	46·8	47·8

L. M. J.

Specific Heats of Gases and Properties of Isothermals. By Emile H. Amagat (*Compt. rend.*, 1896, **122**, 120—121).—Experiments made by Witkowski on the specific heat of air between 0° and −140°, and under pressures from 1 to 140 atmos., show that at low temperatures the variations in the coefficients for air become considerable, and these variations and the characters of the isothermals agree with those traced by the author for carbonic anhydride and for ethylene.

C. H. B.

Latent Heat of Evaporation of Benzene. By Ernest H. Griffiths and Dorothy Marshall (*Phil. Mag.*, 1896, [5], **41**, 1—37).—The latent heat of evaporation of benzene has been determined by the authors, employing the method of experiment and the apparatus used by Griffiths in his determination of the latent heat of evaporation of water (*Phil. Mag.*, 1895, [5], **39**, 261—341). The latent heat of evaporation of benzene over the temperature range 20° to 50° (nitrogen scale) is represented by the equation

$$L = 107{\cdot}05 - 0{\cdot}158\,\theta,$$

where L is expressed in terms of a thermal unit at 15°. Assuming this formula to hold up to the normal boiling point of benzene, 80·2°, at this temperature L would be 94·37.

H. C.

Method of comparing directly the Heats of Evaporation of different Liquids at their Boiling Points. By Dorothy Marshall and William Ramsay (*Phil. Mag.*, 1896, [5], **41**, 38—52).—The heats of evaporation of two liquids may be compared by raising the temperature of each to its boiling point (surrounding each vessel with a jacket of its own vapour), and then determining the loss of weight sustained by each vessel when a current of electricity is passed through a carbon filament immersed in the liquid. All other conditions being made the same for the two vessels, the ratio of their

	Ratio to benzene.	L.	*t*.	M.	$\frac{ML}{T}$.
Benzene	1·000	94·4	80·2	77·40	20·65
Toluene	0·920	86·8	110·8	91·30	20·61
Metaxylene	0·877	82·8	138·5	105·20	21·03
Water	—	536·6	100·0	17·86	25·64
Alcohol	2·293	216·5	78·2	45·66	28·09
Acetic acid	1·028	97·0	118·5	59·52	14·72
Methylic formate	1·167	110·1	31·8	59·52	21·45
Ethylic formate	1·000	94·4	54·3	73·42	21·13
Methylic acetate	1·028	97·0	57·1	73·42	21·53
Propylic formate	0·956	90·2	80·9	87·32	22·38
Ethylic acetate	0·933	88·1	77·15	87·32	21·93
Methylic propionate	0·943	89·0	79·7	87·32	21·99
Propylic acetate	0·881	83·2	101·25	101·22	22·45
Ethylic propionate	0·867	81·8	99·2	101·22	22·22
Methylic butyrate	0·814	79·7	102·7	101·22	21·43
Methylic isobutyrate	0·794	75·0	92·3	101·22	20·74

losses of weight should give the inverse ratio of the heats of evaporation of the liquids. Then, if the heat of evaporation of any one liquid is known, the absolute value of the heat of evaporation of any other liquid can be calculated from the ratio directly found.

The authors have been engaged in working out and perfecting the experimental details of this method of comparison, and, by adopting arrangements which are described in the paper, have been able to obtain satisfactory results. The latent heat of evaporation of benzene at the boiling point 80·2°, as determined by Griffiths and Marshall (preceding abstract), has been used as the standard of comparison.

The results obtained are given in the table on the preceding page.

H. C.

Strontium and Calcium Iodides. By TASSILLY (*Compt. rend.*, 1896, **122**, 82—84).—Strontium iodide crystallises at about 60° with 7 mols. H_2O, and attempts to obtain a hydrate with 6 mols. H_2O were unsuccessful. Heat of dissolution of $SrI_2,7H_2O = -4·47$ Cal. Combining this with previous results

Sr solid + I_2 gas + $7H_2O$ liquid =
$SrI_2,7H_2O$ .... develops +158·07 Cal.
Sr solid + I_2 solid + $7H_2O$ liquid =
$SrI_2,7H_2O$ .... „ +147·27 „

Calcium iodide yields long needles of the hydrate $CaI_2,8H_2O$. Heat of dissolution +1·735 Cal.

Ca solid + I_2 gas + $8H_2O$ liquid =
$CaI_2,8H_2O$ .... develops +144·47 Cal.
Ca solid + I_2 solid + $8H_2O$ liquid =
$CaI_2,8H_2O$ .... „ +133·67 „

C. H. B.

Heats of Formation of Manganese Compounds. By HENRY L. LE CHATELIER (*Compt. rend.*, 1896, **122**, 80—82).—The heats of formation were determined by burning the compounds in a calorimetric bomb with known weights of carbon and pure paper, the manganese, as a rule, being converted into the oxide Mn_3O_4. The following results were obtained.

$Mn_3 + 2O_2 = Mn_3O_4$ develops + 328 Cal. or 82 × 4 Cal.

Carbide :—$Mn_3C + 3O_2 = Mn_3O_4 + CO_2$ .. develops +412·4 Cal.
Mn_3 + C (diamond) = Mn_3C .... „ + 10·4 „
Monoxide :—$3MnO + O = Mn_3O_4$ .... „ + 55·2 „
$Mn + O = MnO$........... „ + 90·8 „
Peroxide :—$3MnO_2 = Mn_3O_4 + O_2$ .... „ − 48·0 „
$MnO + O = MnO_2$.......... „ + 34·0 „
$Mn + O_2 = MnO_2$ .... „ +126·0 „
Carbonate :—$3MnCO_3 + O = Mn_3O_4 + 3CO_2$ „ − 27·8 „
$MnO + CO_2 = MnCO_3$...... „ + 27·6 „
Silicate :—SiO_2 (quartz) + $MnO = MnO,SiO_2$ „ + 5·4 „

C. H. B.

Solubility of Gases. By Dmitri P. Konowaloff (*J. Russ. Chem., Soc.*, 1894, **26**, 48—49).—The author's experiments with a view to ascertain if the law of Dalton holds good in the case of dissolving carbonic anhydride in aniline, have shown that at two different temperatures, namely, 0° and 19·3°, the relation between the volumes of the dissolved gas and the observed pressure (which ranged between 600 and 900 mm.) remained constant.

A point of great interest is the examination of solutions of ammonia in water: these do not follow Dalton's law at temperatures near the ordinary, but approximate to it as the temperature increases, until at 100° the agreement is perfect.

Experiments as to the electric conductivity of ammonia solutions at higher temperatures led to results which are entirely opposed to electrolytic theories. The conductivity is directly proportional to the increase of temperature; the mean coefficient of increase between 18° and 100° being equal to about 2 per cent., a figure similar to that of salt solutions. At 95°, the conductivity is about three times what it is at 18°. The following are examples of the results.

Percentage of NH_3.	3·10.		9·48.	
Temperature	18°	95°	18°	95°
Coefficient of conductivity	9·8	26·1	9·6	29·7

S. G. R.

Experimental Proof of the Laws of van't Hoff, Arrhenius, Ostwald, and Dalton for Dilute Solutions. By Mejer Wildermann (*Zeit. physikal. Chem.*, 1896, **19**, 233—250).—The values previously obtained by the author for the van't Hoff constant were 1·84—1·85, and as the experiments were performed with a convergence temperature above the freezing point the experiments were repeated under the reversed condition. The results, after all necessary corrections, were in good accord, and again gave values 1·84—1·85. The slight difference from the calculated value may be due to fundamental causes, or to an inaccurate thermometer scale, and experiments with resorcinol and cane sugar at another part of the thermometer scale gave the higher value 1·87. Experiments were made with sulphuric, dichloracetic, trichloracetic, and *o*-nitrobenzoic acids, and potassium chloride, to test the law of Arrhenius, and the values for the dissociation obtained from the freezing point and from the conductivity showed close agreement. The dilution law of Ostwald was tested in the case of dichloracetic, *o*-nitrobenzoic, and trichloracetic acids, the constancy of expression $\Delta^2 d/1-\Delta$ being satisfactory, and the variations actually occurring being irregular. Dalton's law, as applied to dilute solutions, was tested by mixtures of carbamide and resorcinol, carbamide and cane sugar, carbamide and dextrose, dextrose and aniline, and alcohol and carbamide. In all cases the law was found applicable, but the carbamide-resorcinol experiments are alone recorded. The non-influence of a non-electrolyte on the dissociation, and the decrease of the latter by the presence of a similar ion have been also proved, but the publication of the complete results is postponed.

(See also Abstr., 1895, ii, 105; this vol., ii, 290.) L. M. J.

Electrolytic Dissociation in Formic acid Solutions. By HUGO ZANNINOVICH-TESSARIN (*Zeit. physikal. Chem.*, 1896, **19**, 251—260).—Nernst, having shown that the dissociating power of a solvent appears to be intimately connected with its dielectric constant (Abstr., 1894, ii, 266), the author undertook the determination of the degree of dissociation of solutions in formic acid, as this compound is distinguished by a very high dielectric constant ($K = 62{\cdot}0$). The salts employed were lithium chloride, chlorides and bromides of sodium, potassium, and ammonium, hydrochloric, acetic, and trichloracetic acids, the freezing point method being employed for the determinations. The salts in all cases exhibited strong dissociation, but the acids acted practically as non-electrolytes, hydrogen chloride apparently forming double molecules. Lithium chloride also appears to form double molecules in acetic acid solutions, whilst the order of the dissociation degree differs in these two solvents. Conductivity experiments are attended with more difficulty, owing to the conductivity of the acid itself, due probably either to true dissociation or to the presence of water. Potassium and sodium chlorides, hydrochloric and trichloracetic acids, however, gave results in accord with the cryoscopic experiments. L. M. J.

Freezing Points of Dilute Solutions. By WALTHER NERNST and RICHARD ABEGG (*Phil. Mag.*, 1896, [5], **41**, 196—199; compare Abstr., 1895, ii, 155).—A reply to Jones' criticism (this vol., ii, 155) of the authors' results. H. C.

Freezing Points of Dilute Aqueous Solutions. By E. H. LOOMIS (*Ann. Phys. Chem.*, 1896, [2], **57**, 495—520).—Making use of the method described in a former paper (Abstr., 1894, ii, 228), the author has determined the freezing points of a number of dilute aqueous solutions, taking great precautions to ensure the highest degree of accuracy. The only alteration made in the apparatus previously used was the substitution of a freezing-point tube of 200 c.c capacity for the 70-c.c. tube formerly employed. In each case the specific gravity and the conductivity of the solution employed were also measured. The substances examined were hydrochloric and phosphoric acids, the chlorides of potassium, ammonium, barium, and magnesium, the nitrates of potassium, sodium, and ammonium, and the sulphates and carbonates of potassium and sodium. The results obtained are given in tabular and curve form.

In these solutions, as in those of the other electrolytes which were formerly examined, the molecular reduction of the freezing point is found to increase continuously with rising dilution. The only exceptions to this rule are afforded by magnesium chloride and hydrochloric acid, in solutions of which the molecular reduction attains a *minimum* value when the concentration is about 1/10 gram mol. per litre. The molecular reduction for salts of monobasic acids and radicles differs considerably in amount from that of salts containing dibasic radicles, and the increase which takes place on rising dilution is relatively more marked in the case of salts of the latter type. The results are extremely regular, and, when plotted in curve form, show no breaks or sudden changes of curvature.

The amount of electrolytic dissociation was calculated from the results for the solutions examined and compared with that calculated from the conductivities. With few exceptions, a striking agreement was observed, particularly in the cases of potassium chloride and sulphate. The differences are, however, in some cases greater than could be accounted for by experimental error, more particularly with the more concentrated solutions. It is also noticeable that although, according to the dissociation theory, the potassium salts should have a greater molecular reduction than the sodium salts in all cases, with the exception of the carbonates, the reverse was observed.

H. C.

Determination of the Freezing Points of Dilute Solutions. By E. H. Loomis (*Ann. Phys. Chem.*, 1896, [2], **57**, 521—532).—The author replies to objections raised by Jones, Wildermann, and others to his method of determining freezing points (Abstr., 1894, ii, 228; 1895, ii, 7, 105).
H. C.

Solubility at the Solidifying Point of the Solvent. By Henryk Arctowski (*Zeit. anorg. Chem.*, 1896, **11**, 272—277).—The author has determined the solubilities of sulphur, bromine, iodine, mercuric iodide, and tin tetriodide in carbon bisulphide, and of iodine in benzene, chloroform, and ether, at temperatures close to the solidifying point of the solvents. The results lead to the conclusion that the solubility curve may be prolonged beyond the point of solidification of the solvent, and that this point has no peculiar significance on the curve. It appears probable that no substance is completely insoluble in one of its solvents at the solidifying point of the solvent.

H. C.

The Polythionates. By Hans Hertlein (*Zeit. physikal. Chem.*, 1896, **19**, 287—317).—The methods of preparation and purification for the polythionic acids and their potassium salts are first given, after which the observations of the physical properties are recorded. The molecular volume is found to increase regularly from the dithionates to the pentathionates, the differences being 12·75, 14·35, and 12·45 (calc.). The conductivity was determined by Kohlrausch's method, and the velocity of the acid ion calculated. In the case of the dithionates, the values thus obtained from the potassium, sodium, barium, and thallium salts were not in accord, the mean of the potassium and sodium results being 85. The velocity decreases with the addition of sulphur, thus $\frac{1}{2}S_2O_6$, 85; $\frac{1}{2}S_3O_6$, 72·8; $\frac{1}{2}S_4O_6$, 67·4; $\frac{1}{2}S_5O_6$, 61·4. Both dithionic and tetrathionic acids are found to be strong acids, the degree of dissociation at $v = 43{\cdot}18$ being respectively 0·896 and 0·92. The internal friction was determined by the method described by Ostwald, and was found to increase with increase in the sulphur content. The determinations of the molecular refraction were made with a Pulfrich's refractometer with the following results for sodium light at 20°.

	I.	II.	Diff. I.	Diff. II.
Potassium dithionate	50·24	29·71		
„ trithionate	64·69	38·15	14·45	8·44
„ tetrathionate	79·39	46·68	14·70	8·53
„ pentathionate	94·92	55·72	15·53	9·04

The values in (I) and (II) are calculated by Gladstone's and Lorenz' formulæ respectively, and from these it appears that the sulphur is present in all the compounds in the bivalent state. Observations of the molecular volume in solutions were made, and also determinations of the electromotive force with different electrodes, the latter experiments indicating that the metal is not directly united to sulphur. The author considers the physical properties of the compounds to accord best with the constitutional formulæ proposed by Mendeléeff (*Principles of Chemistry*). L. M. J.

Molecular Solution Volumes and Molecular Volumes of Organic Compounds. By Isidor Traube (*Annalen*, 1896, **290**, 43—122; compare Abstr., 1895, ii, 70 and 209).—The author brings forward the experimental details on which are based the conclusions already indicated (this vol., ii, 152).

In addition to the points noticed (*loc. cit.*), it is observed that the molecular solution volume is not only additive and constitutive in character, but also configurative, the volumes of crotonic, dibromocrotonic, allocinnamic, allofurfuracrylic, maleïc, and citraconic acids being appreciably smaller than those of the trans-modifications; differences also occur between the molecular solution volumes of ortho-compounds and the values obtained for the meta- and para-isomerides.

The property of polysterism (Abstr., 1895, ii, 71) is exhibited by nitrogen, phosphorus, chlorine, bromine, and iodine, and it is found that in monhalogenised acids the three last-named elements have an atomic solution volume = 13·2 c.c., and, therefore, identical with the value for cyanogen. The author's results indicate the quinquavalence of nitrogen in nitro-groups, and evidence is adduced in favour of ring structure in amido-acids. M. O. F.

Velocity of Reaction between Ethylic Iodide and Silver Nitrate in Ethylic and Methylic Alcohols. By V. Chiminello (*Gazzetta*, 1895, **25**, ii, 410—418).—The author has determined the velocity of reaction between ethylic iodide and silver nitrate in ethylic and methylic alcohol solutions at 0°, 10°, and 15° for different times; action was arrested by pouring the mixture into water, and the unchanged silver nitrate was titrated with thiocyanate.

In ethylic alcohol at 0°, the reaction is of the first order, the velocity coefficient *AK* being 0·0188 and 0·0143 at 5 and 180 minutes respectively, so that at this temperature action probably proceeds in accordance with the equation $EtI + AgNO_3 = AgI + EtNO_3$.

At higher temperatures, the velocity coefficient diminishes considerably as the time increases; thus at 10° the values of AK for 2 and 90 minutes are 0·0639 and 0·0251 respectively, indicating that secondary action occurs at temperatures above 0°; the secondary action, perhaps, proceeds in accordance with the equation given by Bertrand, $C_2H_5{\cdot}NO_3 + C_2H_5{\cdot}OH = C_2H_5{\cdot}NO_2 + CH_3{\cdot}CHO + H_2O$; the author was only able to detect in the liquid ethylic nitrite and acetic acid, the oxidation product of the acetaldehyde produced.

The velocity coefficients in methylic alcohol decrease continuously as the time increases, being at 0°, 0·0660 and 0·0248 at 2 and 100 minutes respectively; the considerable rise in the velocity coefficients attending the change of solvent is evidently due to the general accelerating effect of methylic alcohol, whilst the gradual diminution of the coefficient as the time increases, is probably caused by secondary action, according to the equation $EtI + MeOH = MeI + EtOH$.

W. J. P.

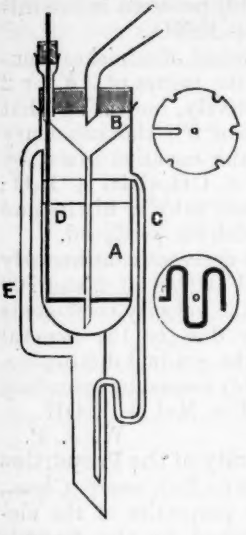
Function corresponding with the Periodicity of the Properties of the Elements. By Flavian M. Flavitzky (*Zeit. anorg. Chem.*, 1896, **11**, 264—267).—The relationship of the properties of the elements to their atomic weights may be expressed by the formula $\alpha \cot 2\pi\phi(p)$, where α is a constant dependent on the property under discussion, and $\phi(p)$ is a function of the atomic weight p. This formula, which was proposed by the author in 1887, is practically identical with that recently put forward by Thomsen (this vol., ii, 16).

H. C.

Eutropic Series. By W. Ortloff (*Zeit. physikal. Chem.*, 1896, **19**, 201—227).—From the examination of the known physical constants of the metals beryllium, magnesium, zinc, cadmium, mercury, iron, cobalt, and nickel, and of a large number of their compounds, the author shows that they fall into two eutropic series, that is, series in which not only the physical properties, but also the crystallographic constants exhibit a regular variation. In the first series, consisting of the compounds of the first five metals, the increase of molecular weight is generally associated with an increase in specific gravity, molecular volume, index of refraction and molecular refraction, but a decrease in the hardness and specific heat. In the second series, with increasing molecular weight is associated an increasing index of refraction and specific gravity, but a decreasing molecular volume, molecular refraction, and hardness. In both series, in the monoclinic compounds, the a-axis decreases and the c-axis increases with increasing molecular weight, whilst in the hexagonal compounds, the c-axis increases in the first series but decreases in the second. Exceptions in this respect are usually associated with other anomalies in the physical properties of the compound.

L. M. J.

Extraction Apparatus for Liquids. By A. Kurbatoff (*J. Russ. Chem. Soc.*, 1894, **26**, 39—40).—A modification of the ordinary



Soxhlet apparatus. The vapour of the solvent enters the condenser through the tube E, and after condensation drops into the funnel B, passes to the bottom of the cylinder A, and, being lighter than the liquid to be extracted, rises through it and flows down into the recipient through the tube C. A little agitator D, is suitably arranged in the cylinder A, and proves very useful in certain cases, such as milk.

Results obtained by this apparatus have been found to be in perfect accordance with those obtained in Soxhlet's apparatus.

S. G. R.

Lecture Experiment. Combustion of Oxygen in Ammonia, &c. By Iwan P. Ossipoff (*J. Russ. Chem. Soc.*, 1894, **26**, 55—56).—A beaker is about half filled with strong solution of ammonia, and the liquid moderately heated so as to replace the air in the beaker by ammonia. A slow current of oxygen is then passed into the beaker through a tube which almost touches the surface of the liquid. A light is then brought near the beaker, and as soon as a flame appears at the end of the oxygen tube, the latter is quickly immersed in the liquid. Simultaneously the current of oxygen is increased, and instantly a whole sheaf of pale greenish flame will be seen above the liquid.

In connection with this experiment, it has been found that oxygen burns very well in paraffin oil and alcohol, and that lighting-gas burns in fuming nitric acid. The apparatus used is in all these cases the same as the above.

S. G. R.

Inorganic Chemistry.

Preparation of Hydrogen Bromide and Hydrogen Iodide. By J. H. Kastle and J. H. Bullock (*Amer. Chem. J.*, 1896, **18**, 105—111).—*Hydrogen Bromide.*—Bromine is allowed to flow slowly from a tap-funnel into a solution of naphthalene (15 to 20 grams) in a little orthoxylene. Hydrogen bromide is at once evolved, and is freed from bromine by passing through concentrated aqueous hydrobromic acid holding red phosphorus in suspension, and then through a U-tube containing red phosphorus; and from moisture by means of phosphoric anhydride. The flow of bromine once regulated, the evolution proceeds regularly. Petroleum boiling above 150° may be used instead of xylene. The yield of hydrogen bromide is 91 per cent. of the theoretical.

Hydrogen Iodide.—Ten grams of finely divided iodine are mixed with an equal bulk of finely powdered resin (colophony), and the whole with an equal bulk of white sand. The mixture is heated in a retort, the neck of which passes into a Woulff's bottle, where a brownish liquid condenses together with iodine, while hydrogen iodide passes on, and is freed from iodine by red phosphorus and from moisture by phosphoric anhydride; it is then perfectly colourless. Ten grams of iodine yielded 5·4 grams of the acid. The method is very rapid, and well suited for lecture demonstrations.

A. E.

Properties of Liquid Hydrogen Iodide. By R. S. Norris and F. G. Cottrell (*Amer. Chem. J.*, 1896, **18**, 96—105).—The liquid was formed by passing dry hydrogen iodide into a stoppered tube surrounded by solid carbonic anhydride; the tube was then removed from the carbonic anhydride, the stopper being held in place by a clamp; the liquid could thus be kept at the temperature of the room for two or three hours before it all escaped. It is limpid and colourless. The solid, formed on freezing it, is heavier than the liquid, and resembles ice in appearance. Sunlight rapidly liberates iodine from the liquid, the action becoming less as the amount of free iodine in the solution increases. Silver, mercury, copper, tin, iron, aluminium, sodium, and potassium were attacked, giving iodides and liberating hydrogen; lead, bismuth, cadmium, antimony, zinc, magnesium, and thallium were not acted on. Of the above metals, liquid hydrogen chloride dissolves only aluminium (Gore, *Phil. Mag.*, 1865, [4], **29**, 541). Cupric oxide and manganese dioxide dissolved quickly, forming cuprous and manganous iodides. Dry sodium and calcium carbonates were quite unacted on. Sulphur gradually dissolved, forming hydrogen sulphide and liberating iodine. Carbon bisulphide merely dissolved. Water refuses to mix with the acid, and if shaken with it breaks into globules, which rise to the surface.

Liquefied gases were introduced in thin sealed tubes, which were broken by shaking. Chlorine, issuing from a small hole in the tube, liberated iodine, and, as the action became more energetic, burst into flame. Liquid cyanogen liberated iodine, forming hydrogen cyanide and a flocculent precipitate. Liquid sulphurous anhydride set free sulphur and iodine, and formed hydrogen sulphide. Liquid ammonia reacted violently forming ammonium iodide. Alcohol and ether both form ethylic iodide.

On the whole, liquid hydrogen iodide is more inert than the gas, and more active than liquid hydrogen chloride. A. E.

Molecular Weight of Sulphur. By William R. Orndorff and G. L. Terrasse (*Amer. Chem. J.*, 1896, **18**, 173—207).—The molecular weight of sulphur in solution in toluene and in carbon bisulphide, as determined by the boiling point method, is in each case 288, corresponding with S_9. The monoclinic and orthorhombic forms have therefore the same molecular weight.

As the result of a large number of experiments carried out in solutions of varying degrees of concentration, the following conclusions are arrived at.

(1) In solvents boiling below the melting point of sulphur, such as toluene, carbon bisulphide, and benzene, the sulphur molecule is represented by S_9.

(2) In solvents boiling above the melting point of sulphur, such as metaxylene, phenol, and phenetoïl, the molecule corresponds with S_8.

By solution in sulphur chloride this complex molecule is apparently dissociated, since, as a mean of 12 experiments conducted in this solvent, a molecular weight of 61·9 corresponding with S_2 was arrived at.

The authors have also made molecular weight determinations of this substance, by means of the depression in the freezing point, when dissolved in naphthalene and diphenyl, with a result in the former case of 224, corresponding with S_7, and in the latter of 256 corresponding with S_8. They, however, attach very little importance to these results, the cryohydrate temperatures of these solvents with sulphur lying so near their freezing points. J. F. T.

Thionyl Bromide and Chlorobromide. By ADOLPHE BESSON (*Compt. rend.*, 1896, **122**, 320—322).—When dry hydrogen bromide is passed into thionyl chloride at a temperature not exceeding 100°, and the product is fractionated under reduced pressure, thionyl chlorobromide and bromide, and sulphur bromide are obtained.

Thionyl chlorobromide, $SOClBr$, is a pale yellow liquid which boils and slightly decomposes at about 115° under normal pressure, and does not solidify at $-23°$; sp. gr. = 2·31 at 0°. At a temperature a little above its boiling point, it decomposes into sulphurous anhydride, thionyl chloride, bromine, and sulphur bromide, and the same decomposition takes place slowly in the cold. In contact with mercury, thionyl chloride and mercurous bromide are formed, sulphur is liberated and sulphurous anhydride is given off.

Thionyl bromide, $SOBr_2$, is an orange-yellow liquid which boils at about 68° under a pressure of 40 mm., and does not solidify at $-23°$; sp. gr. = 2·61 at 0°. When heated, it decomposes rapidly into bromine, sulphur bromide, and sulphurous anhydride. In contact with mercury, it yields sulphur, sulphurous anhydride, and mercurous bromide. Thionyl bromide is not formed by the action of sulphurous anhydride on phosphorus pentabromide.

Both the chlorobromide and the bromide are rapidly decomposed by water. C. H. B.

Action of Carbonic Chloride on some Hydrogen Compounds. By ADOLPHE BESSON (*Compt. rend.*, 1896, **122**, 140—142).—Phosphonium bromide acts slowly on carbonic chloride in the cold, but very rapidly at 50°, and in sealed tubes, the action is complete in a few hours. The products are hydrogen chloride, hydrogen bromide, and hydrogen phosphide, carbonic oxide, and solid yellow hydrogen phosphide.

Hydrogen iodide dissolves readily in carbonic chloride, but, even when cooled with ice and salt, there is a violent action, with liberation of iodine. Phosphonium iodide reacts slowly with the chloride at 0°, and in sealed tubes between 0° and 10°, the action proceeds somewhat rapidly with production of hydrogen chloride, carbonic oxide, phosphorus iodide, P_2I_4, and red phosphorus, which retains about 10 per cent. of iodine, seemingly in the form of a subiodide.

Hydrogen phosphide is practically without action on carbonic chloride; hydrogen sulphide acts at 200° under pressure with formation of sulphurous and carbonic anhydrides, and carbon oxysulphide; hydrogen selenide at 200° yields selenium, hydrogen chloride, and carbonic oxide, and at 230° the selenium acts on the excess of carbonic chloride with production of selenium chloride.

C. H. B.

Solubility of Sodium Thiosulphate in Alcohol. By F. PARMENTIER (*Compt. rend.*, 1896, **122**, 135—137).—The author has repeated Brunner's experiments with ordinary sodium thiosulphate (Abstr., 1895, ii, 488), and also with the modification of the thiosulphate described by himself and Amat (Abstr., 1884, 819). With absolute alcohol, the thiosulphate cannot be completely fused in sealed tubes even at 100°; with alcohol of 80°, it melts at 41° and not at 47·9°, and with alcohol of 63°, at 33°. The salt superfused in presence of alcohol of 80°, solidifies in the allotropic modification when cooled with a mixture of ice and salt, but the product melts at 28° instead of 32° (*loc. cit.*). The determinations of solubility do not agree with those of Brunner, and show that, although the solubility of the crystallised thiosulphate is constant with the quantity of solvent (alcohol and water), the solubility of the superfused thiosulphate increases with the volume of the solvent. The concentration of the alcohol above the superfused salt also varies, and a complex condition of equilibrium is set up between the alcohol, the water, and the anhydrous salt. C. H. B.

Sodium Sulpharsenate. By LE ROY W. MCCAY (*Zeit. anal. Chem.*, 1895, **34**, 725—730).—A feebly alkaline solution of sodium arsenate was saturated with hydrogen sulphide and heated in a closed flask. The cooled solution was then poured into alcohol, and the precipitated salt air-dried. Analyses, in which the arsenic pentasulphide, sodium, and water were all directly estimated, showed the composition to be $Na_3AsS_4,8H_2O$, the numbers agreeing far less closely with the hitherto accepted formula $2Na_3AsS_4,15H_2O$.

The author is unable to confirm Nilson's statements as to the existence of orthosulpharsenic acid, H_3AsS_4. The precipitate obtained by adding a mineral acid to a dilute solution of the sulpharsenate consists of hydrated arsenic pentasulphide, with only traces of hydrogen sulphide, which are easily and completely removed by a current of hydrogen. The precipitate loses its water completely in a vacuum, or when dried at 87°. M. J. S.

Lithium Hydride. By ANTOINE GUNTZ (*Compt. rend.*, 1896, **122**, 244—246).—Lithium combines somewhat rapidly with hydrogen at a dull red heat, but the conversion into hydride is incomplete. At a bright red heat, however, combination takes place with incandescence, and the vapour of the lithium combines with the hydrogen to form a white solid hydride, LiH, which is deposited on the cool parts of the tube. It is not deliquescent, and alters very slowly when exposed to air, but is decomposed by water with formation of the hydroxide and liberation of hydrogen. When heated in nitrogen, it is converted into the nitride, and when heated in air, it burns and yields the oxide. C. H. B.

Magnesium Silver Nitrite. By LEOPOLD SPIEGEL (*Chem. Zeit.*, 1895, **19**, 1423).—A solution of silver nitrite and magnesium nitrite in molecular proportion was boiled during a considerable time, filtered, when cool, from excess of silver salt, and evaporated to a syrupy consistency. After separation from the last traces of silver nitrite, the liquid was submitted to desiccation in a vacuum. The residue, which crystallised in glistening needles, was powdered, and dried until constant in weight. The aqueous solution, which quickly blackened on exposure to light, was decomposed with nitric acid and analysed. The results agreed with the formula

$$19Mg(NO_3)_2,AgNO_3 + 50H_2O.$$

A. L.

Inertness of Alkaline Earths with respect to Hydrogen Chloride. By VICTOR H. VELEY (*Ber.*, 1896, **29**, 577—580).—Hydrogen chloride was dried by passing it in a slow stream through sulphuric acid, over phosphoric anhydride, and through a tube packed with pumice and freshly ignited lime (on which the dry gas has no action in the cold); it was then passed over the dry base that was to be experimented with. At the ordinary temperature, dry hydrogen chloride has no action on dry lime; at 40° there is a very slight action, and at 80° nearly half of the gas is absorbed, and water is seen to be formed. Magnesia reacts a little more readily, probably owing to its being in a state of finer division. Baryta reacts even at the ordinary temperature, but it is difficult to get it quite dry.

C. F. B.

Hydraulic Cements. By ORAZIO REBUFFAT (*Gazzetta*, 1895, **25**, ii, 481—393).—The author gives a summary and criticism of the work done by Le Chatelier and others on hydraulic cements during recent years. W. J. P.

Preparation of Pure Strontium Compounds. By S. P. L. SÖRENSEN (*Zeit. anorg. Chem.*, 1896, **11**, 305—378).—The results of a large number of experiments show how difficult it is to separate strontium salts from calcium and barium salts; and that isomorphous salts are more difficult to separate than those which are not isomorphous. Thus, calcium chloride cannot be completely separated from strontium chloride by means of concentrated hydrochloric acid, although, when pure, they behave quite differently towards this reagent. Strontium and barium chlorides which are not isomorphous, although they behave in a similar manner towards concentrated hydrochloric acid, can be almost completely separated by this acid, whereby the greater portion of the barium chloride is precipitated without the slightest trace of strontium chloride. Strontium and barium nitrate cannot be separated; calcium nitrate is, however, easily separated from the two preceding. The sulphates of calcium, strontium, and barium are isomorphous, and although they differ considerably in their solubility and stability towards alkali carbonates, it is impossible to separate them when precipitated together. The best method of preparing pure strontium salts is as follows. Commercial strontium carbonate (95 grams) is dissolved in the least possible quantity of hydrochloric acid, diluted to 400 c.c., and warmed until all the carbonic anhydride is expelled; 5 grams of solid strontium hydroxide is then added, the mixture shaken and warmed on the water bath, filtered, and the filtrate treated with 5—10 c.c. of chlorine water, again warmed, and filtered. By this treatment, any heavy metals which may be present are separated. The filtrate, which should be strongly alkaline, is treated with a slight excess of hydrochloric acid, diluted to 500 c.c., and treated with so much concentrated hydrochloric acid that, on cooling with cold water, a separation of needles takes place. After some time, the clear solution is decanted and the precipitated barium chloride washed with 25—30 per cent. hydrochloric acid, the wash-water being added to the main solution. The solution is then treated with concentrated sulphuric acid (70 grams) mixed with water (500 c.c.), and after remaining until the following day, the precipitated sulphates are separated, washed free from acid, and treated with 10 per cent. ammonium carbonate solution. The product is washed with warm water, and a small portion dissolved in nitric acid, when only a very small quantity of sulphate should remain undissolved; if much undissolved sulphate remains, the product must be again treated with ammonium carbonate. The washed product is then treated with a slight excess of nitric acid, filtered, mixed with 100 c.c. of 66 per cent. nitric acid, and then with 20 c.c. of dilute sulphuric acid (corresponding with about 2 grams SrO), and allowed to remain until the following day. The filtrate is successively treated in the same way with 10 c.c. additions of sulphuric acid until the precipitate is free from barium. The filtrate is now evaporated to dryness, the residue dissolved in water, filtered, evaporated to a pasty consistency, and mixed with 200—300 c.c. of alcohol. The precipitate is separated, washed with alcohol, and again dissolved in water and precipitated with alcohol until free from calcium. By this method 76—77 per cent. of the theoretical quantity of pure strontium salt is obtained.

The following method is employed for the detection of small quantities of calcium in strontium salts. The strontium nitrate (corresponding with 0·5 gram SrO) is dissolved in water and evaporated to complete dryness in a platinum dish; the dry residue is rubbed and well shaken with a small quantity of a mixture of ether and alcohol, the mixture filtered until quite clear, and the filtrate evaporated to dryness. The minute residue thus obtained is dissolved in nitric acid, mixed with ammonia, and treated in a test tube with ammoniacal arsenic acid, when, in the presence of lime, the salt $Ca(NH_4)AsO_4 + 7H_2O$, which is very characteristic when examined under the microscope, is precipitated. By this means 0·05 per cent. of calcium can be easily detected. If ammonium oxalate is employed instead of ammonium arsenate, the presence of 0·03—0·04 per cent. of calcium gives a distinct precipitate, but this precipitate is not characteristic.

Small quantities of barium are detected as follows: The faintly acid solution of strontium nitrate or chloride (0·5 gram SrO) is diluted to 200 c.c., mixed with 5 c.c. of ammonium acetate solution (50 c.c. acetic acid (1 : 1), neutralised with ammonia and diluted to 100 c.c.), and then with 10 c.c. of ammonium chromate solution (1 gram ammonium chromate). The mixture is allowed to remain until the following day, and the precipitate washed with water, dissolved in dilute nitric acid, and mixed with ammonium acetate and ammonium chromate, when, in the presence of 0·033 per cent. of baryta in the strontium salt, a distinct turbidity is obtained. E. C. R.

Zinc Oxyiodides. By TASSILLY (*Compt. rend.*, 1896, **122**, 323—325).—When 20 grams of zinc iodide and 20 grams of water are heated in sealed tubes at 150° with 0·2 gram of zinc oxide, the oxyiodide, $ZnI_2,9ZnO,24H_2O$, or $ZnI_2,9Zn(OH)_2 + 15H_2O$, is obtained in white, hexagonal lamellæ, which act on polarised light. If ammonia is added to a solution of zinc iodide in quantity insufficient to precipitate the whole of the zinc, the oxyiodide, $ZnI_2,5ZnO,11H_2O$, is obtained in slender, microscopic needles.

The ammonio-zinc iodides, $ZnI_2,4NH_3$, and $ZnI_2,5NH_3$, yield only zinc oxide when treated with excess of water; when heated with a small quantity of water in sealed tubes, they both yield the compound $ZnI_2,4NH_3$. The action of zinc oxide on ammonium iodide solution yields a crystalline compound, $3ZnI_2,5NH_3,3H_2O$, but this does not give an oxyiodide on treatment with water. C. H. B.

Silicides. By GUILLAME J. L. DE CHALMOT (*Amer. Chem. J.*, 1896, **18**, 95—96).—*Copper silicide* is obtained in flat, bluish-white crystals, of sp. gr. 4·25, by heating sand and charcoal in an electric furnace in presence of copper. The crystals could not be obtained pure, but analyses indicate the formula Cu_2Si_3. Aqua regia dissolves part of the copper, and silica is formed. A grey crystalline *silver silicide* was obtained by subjecting a mixture of sand, charcoal, lime, and silver to a current of 240 ampères and 25 volts. On boiling for 75 minutes with nitric acid, silica was formed, but only part of the silver was dissolved, indicating that the silver and silicon are in chemical combination. A. E.

Copper Silicide. By VIGOUROUX (*Compt. rend.*, 1896, **122**, 318—319).—Copper and silicon, when heated in a current of hydrogen in a reverberatory furnace, or the oxyhydrogen furnace, yield alloys which become whiter, harder, more brittle, and more resistant, as the proportion of silicon increases from 5 to 15 per cent., and it is only when it reaches 20 per cent. that the product becomes heterogeneous, crystalline, and very brittle.

When copper is heated with about 10 per cent. of silicon in the electric furnace until the excess of copper has volatilised, a definite silicide, $SiCu_2$, is obtained as a very hard, brittle, steel-grey compound, of sp. gr. 6·9 at 18°. It is attacked, with incandescence by fluorine in the cold, by chlorine below a red heat, and by bromine and iodine at higher temperatures. Moist air attacks it at the ordinary temperature, and dry air or oxygen converts it into a silicate below a red heat. It reduces water vapour, and is attacked by the haloïd hydracids at a red heat with production of a haloïd salt of copper and silicochloroform or analogous compounds. Acids attack it energetically, and fused alkali hydroxides or carbonates decompose it completely if it has been very finely powdered. C. H. B.

Action of Heat on Mercurous Iodide. By Maurice François (*Compt. rend.*, 1896, **122**, 190—193).—Mercurous iodide cannot be melted without decomposing, and, if heated in narrow tubes, mercury separates and sinks to the bottom, whilst a mixture of mercurous and mercuric iodides floats on it. At 300°, equilibrium is established when the supernatant mixture contains 36·5 per cent. of mercuric iodide and 63·5 per cent. of the mercurous salt, the limit being the same whether mercurous iodide or a mixture of mercury and mercuric iodide is heated. The dissociation is analogous to that produced by the action of a liquid on a solid.

When mercurous iodide is sublimed, the condensed product contains mercury and mercuric iodide, but a mixture of 2 mols. of mercuric iodide and 1 mol. of mercurous iodide will sublime without decomposing. A similar mixture can be melted without decomposition, and, if allowed to cool, deposits at first crystals of mercurous iodide only, which, however, always retain some of the mercuric salt mechanically.

It is obvious, from these results, that the numbers usually given for the melting and boiling points of mercurous iodide are erroneous.

C. H. B.

New Series of Metallic Ammonium Compounds. By O. Fritz Wiede and Karl A. Hofmann (*Zeit. anorg. Chem.*, 1896, **11**, 379—384).—The *salt*, $Co_2C_2S_7,6NH_3$, is obtained by passing nitric oxide through a mixture of freshly prepared cobaltous hydroxide, aqueous ammonia, and carbon bisulphide. The salt, which is mixed with an amorphous bye-product, is purified by washing with alcohol. It crystallises in black, lustrous rhombohedra, dissolves sparingly in water, yielding a yellowish-green solution, and is soluble in sodium hydroxide with a dark green coloration, at first without evolution of ammonia. It is decomposed by strong acids with precipitation of sulphur, and, when heated, gives off carbon bisulphide. By prolonged heating with sodium hydroxide, all the nitrogen is given off as ammonia. It can also be prepared by warming a mixture of cobalt hydroxide, ammonia, and carbon bisulphide.

The *nickel salt*, $NiCS_3,3NH_3$, is obtained by gently warming a mixture of nickelous hydroxide, ammonia, and carbon bisulphide. It crystallises in transparent, ruby-red needles, is sparingly soluble in water, but easily in sodium hydroxide with an intense, yellowish-red coloration, and, when heated, gives off carbon bisulphide. On exposure to the air, it gives off part of the ammonia and carbon bisulphide.

The *iron salt*, $Fe_2C_2S_7,6NH_3 + 2H_2O$, is obtained in a similar manner to the above. It crystallises in black, tetragonal prisms having a violet iridescence, and decomposes on exposure to air with glowing, and formation of ferric hydroxide. E. C. R.

Iron Nitrososulphides. By C. MARIE and R. MARQUIS (*Compt. rend.*, 1896, **122**, 137—140).—A quite neutral mixture of sodium nitrite, sodium sulphide, and ferrous sulphate, yields no iron nitrososulphide, even on boiling, but, on the addition of a small quantity of acid, the nitrososulphide is formed, and can be extracted with ether. With sufficient acid to decompose all the nitrite, however, the nitrososulphide is destroyed, and seems to be attacked in preference to the nitrite. The best acid to use is carbonic acid, and the best method is to suspend well washed ferrous sulphide in a solution of three times its weight of sodium nitrite, heat at 100°, and pass a current of carbonic anhydride through the liquid. The product forms black crystals of the composition $Fe_3S_2N_5O_6 + 1\frac{1}{2}H_2O$, and is soluble in water, alcohol, ether, chloroform, acetone, and ethylic acetate, but not in benzene or light petroleum. It alters when exposed to air, is decomposed by acids, and, when boiled with potassium hydroxide, yields ferric hydroxide, $Fe_2O_2(OH)_2$, and a new nitrososulphide. When heated with water in sealed tubes at 220°, it yields ammonium sulphate, ferric oxide, and nitrogen, and, when heated alone at 200°, it yields ammonium thiosulphate, sulphite, and sulphate, and a green compound, which is under investigation. The nitrososulphide probably has the constitution, $NO_2\cdot Fe[S\cdot Fe(NO)_2]_2$. C. H. B.

Influence of Oxide of Iron and Alumina in the Reversion of Superphosphate. By ALFRED SMETHAM (*J. Soc. Chem. Ind.*, 1895, **14**, 112—114).—It has been customary of late years to stipulate in contracts concerning deliveries of raw phosphates, for a small minimum of oxide of iron and alumina, any excess to be considered as causing the reversion (precipitation) of double its weight of soluble phosphate.

The author has proved by a large number of experiments that, whereas this rule holds fairly good for the iron, it cannot be applied to the alumina, this substance only causing a reversion corresponding with its own weight. L. DE K.

Uranium Carbide. By HENRI MOISSAN (*Compt. rend.*, 1896, **122**, 274—280).—When 500 grams of green uranium oxide and 60 grams of sugar carbon are heated in the electric furnace with an arc from a current of 900 ampères and 50 volts for about 10 minutes, *uranium carbide*, C_3U_2 ($U = 240$) is obtained as a crystalline, lustrous solid, which scratches rock crystal, but not corundum; sp. gr. = 11·28 at 18°. When powdered, it begins to burn. Fluorine is without action in the cold, but the carbide burns in it when gently heated, and also in chlorine at 350°, oxygen or nitrogen peroxide at 370°, and bromine at 390°. Iodine attacks the carbide, without incandescence, below a red heat, and fused potassium nitrate or chlorate oxidises it with vivid incandescence. The carbide burns in sulphur vapour at the melting point of glass, and in selenium at a lower temperature. Nitrogen attacks it at 1100°, but the conversion into nitride is incomplete. Dilute acids dissolve it slowly in the cold, and concentrated acids on heating. Hydrogen chloride and hydrogen sulphide attack it at about 600°, and ammonia partially converts it into a nitride at a red heat.

In contact with water, about one-third of the carbon is evolved in the form of a gaseous mixture containing acetylene, 0·2 to 0·7; ethylene, 5·0 to 7·0; methane, 78·0 to 81·0; and hydrogen, 13·5 to 15·0 per cent. by volume, whilst the remaining two-thirds of the carbon is converted into a mixture of liquid and solid hydrocarbons.

C. H. B.

Action of Nitric Peroxide on Stannic Salts. By V. THOMAS (*Compt. rend.*, 1896, **122**, 32—34).—When nitric peroxide is passed into a dilute solution of stannic chloride in chloroform, a white crystalline precipitate of the composition $SnOCl_2,3SnCl_4,N_2O_5$ separates. It is hygroscopic and soluble in water, and, when heated, yields a white sublimate of the composition $3SnCl_4,4NOCl$, identical with that described by Hampe.

Under similar conditions, stannic bromide yields a white compound, $SnO_2,3SnOBr_2,N_2O_5$, which is partially decomposed both by water and by heat. Stannic iodide behaves differently; iodine is liberated, and the white compound that is formed has the composition $Sn_5O_{11}(NO_3)_2 + 4H_2O$, and, is, therefore, analogous to the alkali metastannates, except that the alkali metal has been replaced by the group NO_3.

C. H. B.

Tin Thiophosphide. By A. GRANGER (*Compt. rend.*, 1896, **122**, 322—323).—When phosphorus and stannic sulphide are heated below the softening point of glass in adjacent dishes in a glass tube, and the vapour of the former is carried over the latter by means of a current of carbonic anhydride, a *tin thiophosphide*, Sn_3P_2S or $SnP,2NS$, is obtained in brilliant, grey-black scales. It is oxidised when heated in air, and yields stannic and phosphoric anhydrides, but is not attacked by nitric or hydrochloric acid or by aqua regia. Chlorine and bromine attack it in the cold, and, when finely powdered, it dissolves in solutions of alkali hydroxides through which chlorine or bromine vapour is passed. C. H. B.

Alums of Titanium Sesquioxide. By AUGUSTO PICCINI (*Gazzetta*, 1895, **25**, ii, 542—543).—On dissolving titanic hydrate in dilute sulphuric acid, adding the proper quantity of cæsium sulphate, and electrolysing the liquid, it assumes a deep violet colour, and deposits *cæsium titanium alum*, $Cs_2SO_4,Ti_2(SO_4)_3 + 24H_2O$; this consists of cubic crystals showing pyramidal hemihedrism, and has a violet colour, but less intense than that of the corresponding vanadium alum. It rapidly changes in the air, turning white and deliquescing; when heated it loses water and sulphuric acid. It is very sparingly soluble in cold water, and is decomposed by hot water with separation of titanic acid. W. J. P.

Mineralogical Chemistry.

Examination of Terrestrial Emanations for Argon. Gas from Thermæ of Abano. By RAFFAELE NASINI and FRANCESCO ANDERLINI (*Gazzetta*, 1895, **25**, ii, 508—509).—Some 2000 to 3000 litres of gas issue per hour from the central hot spring of Monte Irone, in Abano, recently analysed by the authors (Abstr., 1894, ii, 422). The gas does not contain argon, but consists of the following percentages of various gases: 1·13 of H_2S, 10·73 of CO_2, 0·40 of O_2, 75·74 of N_2, and 12·00 of methane mixed with small quantities of other organic substances. W. J. P.

Graphitoid. By WILLI LUZI (*Zeit. Kryst. Min.*, 1896, **25**, 611; from *Berg-. und Hüttenm. Zeit.*, 1893, **52**, 11—13).—Two analyses of graphitoid, which was isolated by means of acids from the quartz-schist of Kleinolbersdorf, Saxony, gave, after deducting 15·34 and 2·48 per cent. of ash, C = 99·02 and 98·82, H = 0·54 and 0·30 per cent. respectively. Oxygen is also present. From this composition, it is considered that graphitoid, which burns at a fairly low temperature, is not a modification of carbon. L. J. S.

Sperrylite. By T. L. WALKER (*Zeit. Kryst. Min.*, 1896, **25**, 561—564; and *Amer. J. Sci.*, 1896, [4], **1**, 110—112).—The crystals from the only locality known for this mineral (namely Vermilion mine, Algoma District, Ontario), are described, the forms (111), (001), π(210), and π(10.5.2) being present; the crystals are embedded in copper pyrites, but not in the associated pyrrhotite. Sperrylite is dissolved by aqua regia, and more slowly by hydrochloric acid, but is almost insoluble in nitric, sulphuric, and hydrofluoric acids. It is suggested that the metals of the platinum group found in the copper-nickel ores of this district may occur as replacing platinum in sperrylite. An analysis is given of a copper-nickel matt, showing small quantities of gold, silver, platinum, iridium, osmium, and traces of rhodium and palladium. L. J. S.

Etching of Calcite. By AXEL HAMBERG (*Jahrb. Min.*, 1896, i, Ref. 216—222; from *Geol. För. Förh.*, 1895, **17**, 53—73, 453—472).—Plates of Iceland spar were cut in various definite directions, and the loss of weight per unit area (or sometimes the reduction in thickness) determined after they had been allowed to remain in hydrochloric acid. The solubility coefficient for any particular face at any definite temperature, is defined as the amount of calcite in grams dissolved from 1 sq. cm. in one second by hydrochloric acid of sp. gr. 1·09. If l_t be this coefficient at t°, then, at T° it is $l_T = l_t\,(1{\cdot}07473)^{(T-t)}$.

The results obtained are the more accurate when dissolution takes place more quickly. On the easily soluble faces, solution proceeds regularly without the formation of etch figures; but on (100) and

$(\bar{1}11)$ etch figures are developed, dissolution having here gone on in the direction of other planes. Confirmatory results were obtained with calcite cylinders cut in various zones.

Face.	Coefficient at 0·4°.	Coefficient at 15°.	Coefficient at (about) 30°.	
OR (111).......	0·000201	0·000551	0·00167	0·69
∞R $(2\bar{1}\bar{1})$.......	0·000130	0·000335	0·00115	1·02
$\infty P2$ $(01\bar{1})$.......	0·000125	0·000278	0·00093	1·00
$-2R$ $(\bar{1}11)$.......	0·000064	0·000149	0·00061	0·67
$+R$ (100).......	0·000054	0·000159	0·00072	0·94
$+4R$ $(3\bar{1}\bar{1})$.......	0·000140	0·000528	0·00153	—
$-\frac{1}{2}R$ (101).......	0·000213	0·000580	0·00164	0·78
$+R2$ $(30\bar{1})$.......	0·000237	0·000670	0·00179	—
$+2R$ $(5\bar{1}\bar{1})$.......	0·000236	0·000726	0·00197	1·17

With more dilute acid, the same maxima and minima occur, but the difference between them is less. Numerous measurements are given, showing the effects of the presence of calcium chloride and sugar (a non-dissociable substance) with the hydrochloric acid. Acetic acid was also used. The last column in the above table gives the relative solubilities when water containing carbonic anhydride under a pressure of 6 atmos. is used; here sharp etch figures are developed on the basal plane. L. J. S.

Thaumasite from West Paterson, New Jersey. By SAMUEL L. PENFIELD and JULIUS H. PRATT (*Amer. J. Sci.*, 1896, [4], 1, 229—233). This mineral, of anomalous composition, has previously only been found in Sweden; it is now described from West Paterson, N. J., where it occurs in considerable quantity with zeolites in a trap rock. It consists of an aggregation of prismatic crystals, sometimes loose, but more often firm, and resembling white alabaster in appearance. There is a distinct prismatic cleavage, and prism angles of about 60°. The mineral is optically uniaxial and negative; $\omega = 1·519$ (another determination 1·5125), $\epsilon = 1·476$ approx. The sp. gr. is between 1·887 and 1·875; analysis gave

SiO_2.	CO_2.	SO_3.	CaO.	H_2O.	Na_2O.	K_2O.	Total.
9·26	6·82	13·44	27·13	42·77	0·39	0·18	99·99

This agrees with the usual formula, $CaSiO_3,CaCO_3,CaSO_4,15H_2O$. The alkalis exist as impurities, as is shown by their being dissolved, together with a very little thaumasite, in water. For the loss of water, constant weights are obtained at the temperatures 150°, 200°, 250°, 300°, and below redness, the loss in each case being 37·41, 1·82, 1·41, 1·05, 1·08 = 42·77 per cent., respectively. The 13 mols. of water lost up to 150° are considered as water of crystallisation, whilst the four other portions, which are given off at different temperatures, represent four hydroxyl groups which play different parts in the constitution of the mineral. The results are considered to render probable the structural formula $OH\cdot Si(O\cdot CO\cdot Ca\cdot OH)_2\cdot O\cdot Ca\cdot OH + 13H_2O$.

L. J. S.

Salvadorite, a new Copper Iron Sulphate. By WALTER HERZ (*Zeit. Kryst. Min.*, 1896, **26**, 16—18).—This was found as an aggregate of bluish-green and blue crystals, cemented together by weathered iron sulphate, in the Salvador mine, Quetena, Calama, Chili. The somewhat indistinct and rounded crystals are monosymmetric, with *b*(010), and a prism with an angle of 48° 16′ in front. The plane of symmetry is the direction of perfect cleavage, and is the plane of the optic axes. The extinction to the vertical axis is 52° for Na and $46\frac{1}{2}°$ for Tl light; optic axial angle 76° for Na and 87° for Tl light. Analysis of crystals gave

	FeO.	CuO.	SO_3.	H_2O.	Total.
I (green)	8·49	18·77	27·87	44·65	99·78
II (blue)	9·59	17·57	28·16	44·31	99·63

Formula, $FeCu_2(SO_4)_3 + 21H_2O$. Salvadorite thus resembles pisanite in composition and crystalline system, but differs in the crystal habit and angle, in the cleavage, and in the angle of optical extinction. The two minerals may be dimorphous, or one may be an isomorphous mixture and the other a molecular compound, perhaps in salvadorite as $(FeSO_4,7H_2O),2(CuSO_4,7H_2O)$. L. J. S.

Borates in the Stassfurt Abraum Salts. By H. BERNHARD KOSMANN (*Zeit. deutsch. geol. Ges.*, 1893, **45**, 167—170).—For the borates occurring in the abraum salts of the Stassfurt district, the following formulæ are written.

Pinnoite: $MgB_2O_4,3H_2O = MgB_4O_7,3H_2O,MgO,3H_2O = Mg(OH)_2,(BO\cdot OH)_4,H_2Mg(OH)_4$.

Hydroboracite: $CaMgB_6O_{11},6H_2O = 3(CaB_4O_7,3H_2O),CaO,3H_2O,3(MgB_4O_7,3H_2O),MgO,3H_2O$.

Kaliborite: from Feit's analysis, is deduced $K_2Mg_4B_{20}O_{35},17H_2O$, $= 4(MgB_4O_7,4H_2O),K_2B_4O_7,H_2O$; or, if there be $15H_2O$, $4(MgB_4O_7,3H_2O),K_2B_4O_7,3H_2O$.

Ascharite: $3Mg_2B_2O_5,2H_2O = 3(MgB_4O_7),5MgO,4Mg(OH)_2$; or, if there be $\frac{4}{3}H_2O$, $MgB_4O_7,H_2O,3MgO$.

Boracite: $Mg_7B_{16}Cl_2O_{30} = 4(MgB_4O_7),2MgO,MgCl_2$.

L. J. S.

Action of Sulphuric and Hydrochloric acids on Heulandite: an artificial form of Silica. By FRIEDRICH RINNE (*Jahrb. Min.*, 1896, i, 139—148).—When heulandite ($CaAl_2Si_6O_{16} + 4H_2O$) is placed in anhydrous sulphuric acid, the effect is the same as when the mineral is heated at 150°; there being a loss of $2H_2O$, and a change in the optical characters; for example, the optic axes pass twice through a uniaxial position until their plane is *b*(010), the extinctions in the new position conforming with orthorhombic symmetry. When placed in water, there is a change back again to the characters of heulandite.

Dilute sulphuric acid, or hydrochloric acid, completely decomposes the mineral, leaving silica having the form of the heulandite cleavage flakes; this silica shows a negative bisectrix perpendicular to the plate, the magnitude of the optic axial angle varying in different fields; the double refraction is fairly strong. When heated to redness, there is a loss of about 8·8 per cent. of water, but no change in the optical characters. The sp. gr. of 2·143 is near to that of tridymite and of cristobalite, but the optical characters differ.

L. J. S.

Desmine [Stilbite] and Laumontite from the Caucasus. By Petr. A. Zemjatschensky (*Zeit. Kryst. Min.*, 1896, **25**, 574; from *Rev. sci. natur.*, 1893, 335—344).—The optical anomalies of stilbite (from Mt. Borschom, near Tiflis) are explained by the nearly parallel aggregation of small crystal individuals. White, radially fibrous laumontite from the same locality gave analysis I; from this is deduced the formula $Ca(K_2)O,Al_2O_3,4SiO_2,4H_2O$.

	SiO_2.	Al_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O (over H_2SO_4).
I.	52·45	22·05	10·15	0·52	1·40	Nil.	—
II.	57·77	15·76	7·35	Nil.	1·14	0·63	1·98

	H_2O (at 100°).	H_2O (on ignition).	Total.
I.	2·01	14·18	102·76
II.	—	17·28	99·93

Platy and radially fibrous, pale rose-coloured stilbite, from Surám, gave analysis II (by Malys); this corresponds with

$$Ca(K_2,Na_2)O,Al_2O_3,6SiO_2,6H_2O.$$

L. J. S.

Fluorine in Apophyllite. By Adolf E. Nordenskiöld (*Zeit. Kryst. Min.*, 1896, **26**, 92; from *Geol. För. Förh.*, 1894, **16**, 579).—Friedel has failed to find fluorine in the apophyllite of Bou Serdoun, Utö, and Andreasberg (Abstr., 1894, ii, 421). It is pointed out that Berzelius, in 1822, etched glass with the hydrofluoric acid obtained by the action of sulphuric acid on the calcium fluoride derived from apophyllite; and the author obtains the same result with the apophyllite of Utö, Nordmark, Hellestad, Poonah, and Bou Serdoun (compare Abstr., 1895, ii, 276; this vol., ii, 114; also *Zeit. Kryst. Min.*, **26**, 221). The presence of ammonium chloride in the mineral observed by Friedel was noticed by V. Rose in 1805 (*Gehlen's Journal*, 1805, **5**, 35).

L. J. S.

Clarke and Schneider's Constitutional Formula for Serpentine. By A. Linder (*Zeit. Kryst. Min.*, 1896, **25**, 589—592; from *Inaug. Diss., Breslau*, 1893, 1—36).—From the action of dry hydrogen chloride on serpentine, Clarke and Schneider deduced the formula $Mg_2(SiO_4)_2H_3(MgOH)$, only the group $-Mg{\cdot}OH$ being supposed to be acted on by the gas (Abstr., 1891, i, 529). The author repeats these experiments, using 19 serpentines of different texture, &c., and from various localities, and finds that no constant amount of magnesium chloride (such as would correspond with $-Mg{\cdot}OH$ in the above formula) is formed by the action of the dry gas at about 400°, and also at 130—150°; thus at 400° the ratio of the amount of $MgCl_2$ formed to the original amount of MgO varies from 5·3 : 100 to 66·7 : 100. The ferrous iron was also attacked by the gas, but usually to a less extent than the magnesium. Experiments were also made, using as reagents, bromine, ammonium chloride, dry and in solution, acetic acid, potassium and sodium hydroxides, but varying results were obtained. Complete analyses of the 19 serpentines used are given. L. J. S.

Lawsonite, a new Rock-forming Mineral from California. By F. Leslie Ransome and Charles Palache (*Bull. Dept. Geol. Univ., California*, 1895, **1**, 301—312; and *Zeit. Kryst. Min.*, 1896, **25**, 531—537).—Lawsonite occurs as a rock-forming mineral in a crystalline schist at the Tiburon Peninsula, Marion Co., California, in large, tabular crystals embedded in margarite veins, and also in crystals of octahedral or prismatic habit lining and filling cavities. The crystals are orthorhombic, with few forms, and are often twinned on the prism plane; $a : b : c = 0{\cdot}6652 : 1 : 0{\cdot}7385$; cleavage $b(010)$ perfect, $c(001)$ less perfect, $m(110)$ indistinct. The small crystals, when fresh, are clear and colourless, but the larger are of a greyish-blue colour of unequal distribution, much resembling kyanite. The plane of the optic axes is $b(010)$, the acute bisectrix being perpendicular to $c(001)$, optically positive; for sodium light, $2V = 84° 6'$, $\alpha = 1{\cdot}6650$, $\beta = 1{\cdot}6690$, $\gamma = 1{\cdot}6840$; strongly pleochroic in the coloured portions. Hardness about 8, brittle; sp. gr. 3·084 (in powder 3·091). Easily fusible. The mineral is only slightly acted on by boiling, strong hydrochloric acid, but is completely decomposed by hydrochloric acid in a sealed tube at 140°. Analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	Na_2O.	H_2O.	Total.
38·10	28·88	0·85	18·26	0·23	0·65	11·42	98·39

At 225° there is a loss of only 0·1 per cent. Formula, $H_4CaAl_2Si_2O_{10}$, or as a basic meta-silicate, $2Al(OH)_2{:}Ca(SiO_3)_2$; this is similar to carpholite, $H_4MnAl_2Si_2O_{10}$ (monosymmetric ?), with which lawsonite is probably isomorphous, the prism angles of the two minerals being nearly equal. The associated minerals of the schist are margarite, epidote, actinolite, glaucophane, and red garnet. L. J. S.

Minerals (Zeolites, &c.) of a Thuringian Amphibole-granitite. By Johannes Fromme (*Zeit. Kryst. Min.*, 1896, **25**, 616—617; from *Sitzb. phys.-med. Soc., Erlangen*, 1893, **25**, 26—53).—The rock is from near Suhl; from it orthoclase, oligoclase, and lepidomelane were isolated, and in the cavities occur calcite, epidote, hæmatite, pyrites, stilbite, scolecite, chabazite, and heulandite. The results of the analyses are given under I for the reddish orthoclase, II, white oligoclase, somewhat decomposed, and mixed with orthoclase; after deducting orthoclase, the composition is Ab_3An; III, lepidomelane, in very thin plates, brown-yellow, and transparent; IV, stilbite, brownish or yellowish aggregates; V, scolecite, white, radially fibrous aggregates; VI, chabazite, reddish-yellow, mostly simple rhombohedra; VII, heulandite, in good crystals.

	I.	II.	III.	IV.	V.	VI.	VII.
SiO_2 ...	63·19	61·52	34·14	56·42	45·75	50·62	58·31
Al_2O_3...	19·48	24·31	17·78	16·11	26·54	17·14	16·69
Fe_2O_3 ..	0·38	0·48	5·78	0·19	trace	0·42	trace
FeO....	—	—	13·59	—	—	—	—
MnO...	—	—	1·59	—	—	—	—
CaO ...	0·59	4·14	2·07	8·31	13·16	8·77	8·84
SrO....	—	—	—	—	—	trace	
MgO ...	trace	trace	13·21	—	—	—	—
K_2O ...	11·59	2·32	5·70	0·78	trace	1·15	0·79
Na_2O...	4·20	6·10	1·16	0·23	0·59	0·79	0·35
H_2O ...	0·51	1·65	4·50	17·77	13·75	20·74	15·62
	99·94	100·52	99·52	99·81	99·79	99·63	100·60
Sp. gr...	2·564	2·666	3·015	2·168	2·272	2·09	—

As the zeolites have been derived from the felspars, the latter were tested for strontium, but with negative result. The calcite is generally of earlier date than the scolecite, but later than the other zeolites. L. J. S.

Gehlenite and Wollastonite in Slags from Přzibram. By Ph. Heberdey (*Zeit. Kryst. Min.*, 1896, **26**, 19—27).—The slags described are produced on smelting the impure fahl ore of Přzibram. On the black, cryptocrystalline ground-mass are tabular crystals of gehlenite and columnar crystals of wollastonite; the latter, which gave crystallographic measurements, being of rare occurrence in slags as crystals of any size. Thin sections of the ground mass showed a few crystals of gehlenite, and numerous colourless needles of wollastonite and of the hexagonal calcium silicate. The ground-mass is nearly all decomposed by hydrochloric acid; from its analysis is deduced $50CaSiO_3 + 18FeSiO_3 + 4Fe_2SiO_4 + 6MgO,Al_2O_3 + 11FeS + 7ZnS + 9MnS + PbS$. The calcium metasilicate exists as wollastonite, and in the hexagonal form, but it is doubtful how the $FeSiO_3$ occurs. L. J. S.

Epidote from Huntington, Mass.; and the Optical Properties of Epidote. By E. H. Forbes (*Amer. J. Sci.*, 1896, [4], **1**, 26—30; and *Zeit. Kryst. Min.*, 1896, **26**, 138—142).—In the gneiss of Huntington, Mass., are transparent, dark grey crystals of epidote; analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	H_2O.	Total.	Sp. gr.
37·99	29·53	5·67	0·53	0·21	23·85	2·04	99·82	3·367

This gives the usual formula; the iron is low for epidote.

Crystallographic determinations are given. The extinction angle, $a : c$ is 1° 51′ Li, 2° 9′ Na, 2° 12′ Tl, in the obtuse angle β; $2V_{Na} = 89° 28'$, $\rho < v$, optically positive (other epidotes are negative with $\rho > v$). The green portion of a pink and green zoned crystal from the Zillerthal gave Fe_2O_3 6·97, FeO 0·89 per cent.; the inner green portion gave the extinction angle $\mathfrak{a} : c = 0° 30'$, in the acute angle β, and the outer pink portion gave $0° 30'$ in the obtuse angle β, for white light. The determinations for sodium light are compared with those of Klein (1874) for the Untersulzbachthal crystals, showing a gradual change in the magnitude of the optical constants with the amount of iron.

	Fe_2O_3.	α.	β.	γ.	$\gamma - \alpha$.	2V over $\mathfrak{a}$.
(Klein)....	14·0	1·7305	1·7540	1·7677(r)	0·0372	73° 39′
Zillerthal..	6·97	1·720	1·7245	1·7344	0·0144	87 46
Huntington	5·67	1·714	1·716	1·724	0·010	90 32

L. J. S.

Minerals of the Nepheline-syenite of Greenland. By N. V. Ussing (*Zeit. Kryst. Min.*, 1896, **26**, 104—107; from *Meddelelser om Grönland*, 1893-4, **14**).—The principal rock-forming minerals of the nepheline-syenite of S. Greenland are described; these being felspars, nepheline, sodalite, eudialyte, amphiboles, and pyroxenes; lime felspars are absent. The following analyses, by C. Detlefsen, of the alkali-felspars are given: I, microcline from Kunerngit; II, microcline-microperthite from Serrarsuit, after deducting 1·56 per cent. of enclosed ægyrite; III, cryptoperthite from Narsasik.

	SiO_2.	Al_2O_3.	Fe_2O_3.	MgO.	Na_2O.	K_2O.	Loss on ignition.	Total.	Sp. gr.
I.	64·68	19·04	0·24	trace	0·53	15·82	—	100·31	2·567
II.	65·86	18·76	—	—	3·34	12·04	—	100·00	2·580
III.	65·81	19·43	0·40	—	5·61	8·66	0·39	100·30	—

The arfvedsonite is often altered into acmite; the following analysis of the altered material, showing that the change consists mainly in the oxidation of the ferrous oxide (33·43 per cent. of which is given in Lorenzen's analysis of arfvedsonite from this locality).

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	MgO.	CaO.	K_2O.
44·19	4·63	34·67	1·16	0·45	0·18	2·35	0·13

Na_2O.	H_2O.	Total.	Sp. gr.
11·61	0·30	99·67	3·571

L. J. S.

The Olivine Group. By Konstantin Thaddéeff (*Zeit. Kryst. Min.*, 1896, **26**, 28—78).—With the view of tracing a connection between the chemical composition and the sp. gr. of the members of the olivine group, analyses have been made of the Vesuvian forsterite (this vol., ii, 309), the olivine of Dreiser Weiher in the Eifel, I, and of the olivine of Skurruvaselv in Norway, II.

	SiO_2.	FeO.	MgO.	NiO.	MnO.	Al_2O_3.	H_2O.	Total.	Sp. gr.
I.	40·99	8·37	50·00	0·37	0·14	0·40	—	100·27	3·335
II.	38·59	20·29	39·78	—	0·32	0·86	0·40	100·24	3·497

These, as well as numerous quoted analyses, show that the FeO and the sp. gr. increase together. From his determinations of FeO and the sp. gr., the author, assuming an isomorphous series, calculates the sp. gr. of the extreme members of the olivine group, namely Mg_2SiO_4 and Fe_2SiO_4, to be 3·198, and 4·745, respectively. The specific gravities calculated from these values agree with those observed for forsterite and olivines, but in the case of hortonolite and fayalite (observed about 4·35) there are considerable deviations. It is, therefore, considered that in olivine the Fe_2SiO_4 is of a denser modification than in fayalite, and that the whole group forms two independent isomorphous series, similar to those shown by mixed salts of $FeSO_4 + 7H_2O$, and $MgSO_4 + 7H_2O$, as described by Rammelsberg and Retgers; the interval in this case, in which mixed salts do not occur, being, perhaps, between hyalosiderite and hortonolite; for the sp. gr. of the Mg_2SiO_4 in the members at the iron end of the group is calculated 3·278, this being near to that of Ebelmen's artificial forsterite. A similar relation exists in the case of the crystallographic constants as pointed out by Bauer; the *a* and *c* axes increasing slightly in magnitude with the iron as far as hyalosiderite, whilst for fayalite they again decrease.

In analysis II, the water was determined by ignition in dry hydrogen freed from oxygen; determinations were made to find the amount of ferrous iron oxidised when olivine is ignited in the presence of air.
L. J. S.

Fayalite from Rockport, Mass.; and the Optical Characters of the Olivine Group. By SAMUEL L. PENFIELD and E. H. FORBES (*Amer. J. Sci.*, 1896, [4], **1**, 129—135; and *Zeit. Kryst. Min.*, 1896, **26**, 143—149).—Dark green, massive fayalite, associated with magnetite in the granite of Rockport, Mass., gave analysis I (mean of two); the water is considered to be basic, as it is only expelled at a high temperature, and when calculated with RO the ratio $SiO_2 : RO = 0·501 : 1·004$. The optical constants are given under A.

Hortonolite from Monroe, New York, gave analysis II (mean of two), and optical constants B.

Monticellite from Magnet Cove, Arkansas, gave analysis III (mean of two); the water is here neglected as being due to decomposition; optical constants C.

	SiO_2.	FeO.	MnO.	MgO.	CaO.	H_2O.	Total.	Sp. gr.
I.	30·08	68·12	0·72	nil	—	0·80	99·80	4·318
II.	33·77	47·26	4·54	13·88	—	0·48	99·93	4·038
III.	36·78	4·75	1·62	21·60	34·31	0·95	100·01	3·035

	$\alpha_{Na.}$	$\beta_{Na.}$	$\gamma_{Na.}$	$V_{Na.}$	$2H_{Li.}$	$2H_{Na}$	$2H_{Tl.}$
A.	1·8236	1·8642	1·8736	24° 55′	57° 27′	56° 32′	55° 2′
B.	1·7684	1·7915	1·8031	34 42	76 59	76 0	75 45
C.	1·6505	1·6616	1·6679	37 31	75 55	75 21	74 52

The following table shows that in the olivine group (excluding monticellite) as the amount of iron decreases there is a gradual increase in the value of the optic axial angle, the latter changing less rapidly at the magnesium end of the series; the value of β and the strength of double refraction decrease with the iron.

	FeO per cent.	$2V_{Na}$ over $\mathfrak{a}$.	β_{Na}.
Fayalite, Rockport......	68·1	49° 50′	1·864
Hortonolite, Monroe	47·3	69 24	1·791
Olivine, Auvergne......	13·0	89 36	1·692
„ Vesuvius	12·6	89 42	—
„ Hawaii........	10·3	91 2	—
„ Egypt........	9·2	91 19	1·678
„ New Mexico....	8·6	91 24	—
Forsterite, Vesuvius (Des Cloizeaux)...........	2?	93 50	1·657

In the olivine group we always have $a = \mathfrak{c}$, $b = \mathfrak{a}$, $c = \mathfrak{b}$, but when there is less than about 12 per cent. of FeO, the acute bisectrix is $\mathfrak{c}$ (except in monticellite), and with more iron it is $\mathfrak{a}$; in the former case the mineral is optically positive with $\rho < v$, and in the latter negative with $\rho > v$. L. J. S.

A new Alkali Hornblende and a Titaniferous Andradite from Dungannon, Ontario. By Frank D. Adams and Bernard J. Harrington (*Amer. J. Sci.*, 1896, [4], 1, 210—218).—In the nepheline-syenite of Dungannon, Hastings Co., Ontario (Abstr., 1894, ii, 461), two varieties of hornblende occur in different parts of the mass; one of these is near to common green hornblende, although it contains a considerable amount of soda; the other is quite different. It has a small optic axial angle (30° or 45°), a large extinction angle ($\mathfrak{c} : c = 30°$), low double refraction, and pleochroism $\mathfrak{a}$ yellowish-green, $\mathfrak{b}$ and $\mathfrak{c}$ deep bluish-green. Analysis I; calculating the titanium with the silicon, this gives the orthosilicate formula $(R'_2,R'')_3R_2''' Si_3O_{12}$; this is the same as that given by Scharizer for "syntagmatite" in his theory of the composition of aluminous amphiboles (Abstr., 1885, 32). No other hornblende analysis shows so little silica as this. Hornblendes with similar optical characters occur at Montreal and at Umptek in the Kola Peninsula.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.
I.	34·184	1·527	11·517	12·621	21·979	0·629	9·867	1·353
II.	36·604	1·078	9·771	15·996	3·852	1·301	29·306	1·384

	K_2O.	Na_2O.	Loss on ignition.	Total.	Sp. gr.
I.	2·286	3·290	0·348	99·601	3·433
II.	—	—	0·285	99·577	3·739

A brown, isotropic garnet occurs as irregular grains in the same nepheline-syenite; it encloses calcite (apparently not secondary) hornblende, pyrites, iron ore, and nepheline. Analysis II; calculating the titanium as Ti_2O_3, the garnet formula is deduced. Similar garnets occur at Montreal, Stokö, and Alnö. L. J. S.

Chemical Behaviour of some naturally occurring Titanium Compounds. By Rudolf Soltmann (*Zeit. Kryst. Min.*, 1896, **25**, 617—618; from *Inaug. Diss.*, *Bern*, 1893).—The following analyses of sphene were made with the view of ascertaining whether in the light coloured, especially green, specimens the ratio Si : Ti = 1 : 1 holds.

I. Yellow-green plates, (001), from Rothenkopf, Zillerthal, Tyrol.
II. Twins in chlorite from Trümmelbachthal, Prägraten.
III. Light reddish-yellow or pale-greenish crystals in pebbles of hornblende-gneiss, near Meran.

	SiO_2.	TiO_2.	CaO.	FeO.	MnO.	H_2O.
I.	31·53	35·48	28·35	1·89	—	0·36
II.	33·05	37·10	29·79	—	—	0·36
III.	33·38	38·51	29·73	—	trace	—

The single analyses, of which the above are the means, showed fairly wide variations, so that a deviation from the normal ratio could not be deduced. L. J. S.

Meteorite from Forsyth Co., North Carolina. By EMILE A. DE SCHWEINITZ (*Amer. J. Sci.*, 1896, **1**, [4], 208—209).—A mass weighing about 50 lbs. was ploughed up about three years ago in the south-west portion of Forsyth Co. No characteristic etching was produced on polished surfaces; preliminary analysis gave

Fe.	S.	Ni.	Co.	P.
94·90	0·22	4·18	0·33	trace

From this it would seem to be closely allied to the Guilford Co. meteorite, possibly a chip of the same find. L. J. S.

Physiological Chemistry.

Digestibility of the Pentosans of Vegetable Foods. By HUGO WEISKE (*Bied. Centr.*, 1896, **25**, 13—15; from *Oesterr. Ung. Zeits.*, 1895, No. 24, 594).—Two sheep were fed on meadow hay (706·72 grams of dry substance) and oats (219 grams of dry substance), containing respectively 27·64 and 15·55 per cent. of pentosans respectively. Determinations of the pentosans in the fæces of the sheep during the three periods of the experiment showed that an average of 65·1 per cent. was digested. In experiments with rabbits fed on oats, 53·81 per cent. of the pentosans was digested. Assuming the digestive powers of sheep and rabbits to be the same, the pentosans of oats seem to be less digestible than those of meadow hay.

The question whether the pentosans which are digested have a food value remains to be decided (compare Abstr., 1895, ii, 278).

N. H. J. M.

Partition of Urea between Blood Corpuscles and Blood Serum. By BERNHARD SCHÖNDORFF (*Pflüger's Archiv*, 1896, **63**, 192—202).—Urea is a constituent of red blood corpuscles; the amount of urea in the blood is equally divided between corpuscles and serum. If an isotonic solution of urea is added to the blood, the urea is equally shared by the corpuscles and serum. If an isotonic solution of sodium chloride is added, the urea leaves the corpuscles until there is an equal amount in the diluted serum. W. D. H.

Osmotic Pressure of Blood-plasma, and the Formation of Hydrochloric acid in the Stomach. By Hans Koeppe (*Pflüger's Archiv*, 1896, **62**, 567—602).—Inorganic salts increase the energy of the organism; this is seen in the phenomena of diffusion and the action of osmotic pressure.

The action of salt solutions on the osmotic pressure can be estimated by the hæmatocrite; this is especially applicable to blood-plasma. The osmotic pressure of blood-plasma undergoes by no means unimportant variations, being always increased by the midday meal; this is the result of the secretion of hydrochloric acid in the stomach.

In order to equalise the difference between the osmotic pressure of the blood-plasma and that of the stomach contents (that is, a strong solution of sodium chloride) as rapidly as possible, a flow of water into the stomach and a passage of salt into the blood occurs; the stomach wall is impermeable for free chlorine ions, but the sodium ions of the sodium chloride are exchanged for the hydrogen ions of the blood. In the stomach, free chlorine and hydrogen ions are found, hence its contents give the reactions for hydrochloric acid; the acid of the stomach is formed in the stomach wall, the stimulus for its separation being free chlorine ions in the stomach. This explanation of the formation of hydrochloric acid out of the chlorides of the stomach contents depends on the presence of free hydrogen ions in the blood. This is the case, for (*a*) water contains free hydrogen and free hydroxyl ions; (*b*) in the blood, free carbonic anhydride and primary carbonates and phosphates are present. From these materials the hydrogen ion is one of the dissociation products. (*c*) After the exit of the few hydrogen ions from the blood, more are formed by further dissociation.

This explanation of the formation of the hydrochloric acid of the stomach stands in complete accord with the following experimental premisses. (*a*) In spite of the formation of an acid, the cell remains alkaline; (*b*) the alkalinity of the blood is increased; (*c*) in the absence of free chlorine ions in the stomach contents no hydrochloric acid is formed; (*d*) injection of hydrochloric acid into a vein causes no appearance of that acid in the stomach; (*e*) the formation of other acids (hydrobromic, hydriodic) follows the introduction of the sodium salts of the corresponding halogens into the stomach; (*f*) after taking much sodium chloride, the urine may become alkaline.

W. D. H.

Fat Absorption. By Isaac Levin (*Pflüger's Archiv*, 1896, **63**, 171—191).—The absorption of fat from the alimentary canal takes place in two ways, (1) in the form of soluble soaps, (2) in the form of fat droplets. For the latter to occur, not only is emulsification necessary, but the presence of both bile and pancreatic juice is essential for the purpose of stimulating the epithelial cells to take up the fat. If either, or both, are absent, even though emulsification occurs, the chyle is free from fat. The fat droplets are taken up as such, not synthesised within the cells. W. D. H.

Influence of Muscular Work on Proteïd Metabolism. By Otto Krummacher (*Zeit. Biol.*, 1896, **33**, 108—138).—This research (three experiments) performed on human beings was carried out under Voit's supervision. It is pointed out that Voit never denied that proteïd metabolism was increased by muscular work; he stated that the chief source of the energy was not proteïd. Pflüger and his pupils did their work on an insufficient diet, and so more proteïd in the muscle would have to be used up as a source of energy than is usually the case. The present experiments show a small increase in the excretion of nitrogen during rest as compared with work. Full details of ingesta and excreta and the work done (turning the handle of a dynamometer) are given. W. D. H.

Mineral Constituents of Flesh. Julius Katz (*Pflüger's Archiv*, 1896, **63**, 1—85).—The flesh of a large number of animals was investigated, and the results are given in detail. The following numbers give the minimum and maximum in 1000 parts of fresh flesh. K, 2·4 to 4·6; Na, 0·3 to 1·5; Fe, 0·04 to 0·25; Ca, 0·02 to 0·39; Mg, 0·18 to 0·37; P, from phosphates, 1·22 to 2·04, from lecithin, 0·13 to 0·48, from nuclein, 0·09 to 0·32; Cl, 0·32 to 0·8. W. D. H.

Action of Related Chemical Substances on Striped Muscle. By Arthur Blumenthal (*Pflüger's Archiv*, 1896, **62**, 513—542).—In order to make comparative experiments with various chemical materials on living tissues, it is necessary to employ solutions of equal molecular strengths.

Decinormal solutions of the sodium compounds of the halogens stimulate and then destroy muscle; sodium iodide is the most, and sodium chloride the least, powerful. Sodium fluoride is more powerful than the iodide.

The chlorides of potassium, rubidium, and cæsium act as stimulants and then destroy muscle; their activity as stimulants varies with their molecular weights, and as paralysers in the reverse direction. The action of the chlorides of calcium, strontium, and barium is precisely analogous.

With the alkalis (centinormal solutions), the rise of excitability is small; ammonia is most destructive, then potassium hydroxide, then sodium hydroxide.

The inorganic acids (1/200 normal) are destructive in proportion to their avidity, hydrochloric and nitric acids being about equal, then sulphuric acid and, lastly, phosphoric acid.

As regards power of destruction, the fatty acids stand in the order of their molecular weights; the only exception being formic acid, which is more injurious than acetic acid.

The alcohols have a similar relationship; here again, however, methylic alcohol is more poisonous than ethylic alcohol.

Fick's view of muscular activity, that the two processes of shortening and lengthening are independent and separate vital processes, is supported by the fact that some reagents affect only the one and others only the other phase. W. D. H.

Chemistry of some Marine Animals. By Edmund Drechsel (*Zeit. Biol.*, 1896, **33**, 85—107).—The fresh liver of the dolphin contains, like that of the horse, jecorin, cystine, a substance of the xanthine group, and glycogen. Cystine is a product of normal metabolism.

The substance (*gorgonin*) of the horny skeleton of *Gorgonia cavolinii* contains iodine in organic combination. On decomposition with barium hydroxide, gorgonin yields an amido-acid containing iodine (*iodogorgonic acid*, $C_4H_8NIO_2$), which is crystalline, and has the composition of an iodoamidobutyric acid; its constitution is, however, not yet certain.

The living substance of the *Gorgonia* contains no iodine or only the merest traces; it is of proteïd nature, and, on decomposition with hydrochloric acid, yields lysine and probably lysatine.

Gorgonin is also a proteïd; when decomposed with hydrochloric acid, it yields leucine, tyrosine, lysine, lysatine (?), iodogorgonic acid and ammonia. W. D. H.

Analysis of Human Milk. By Friedrich Söldner and William Camerer (*Zeit. Biol.*, 1896, **33**, 43—71).—The analyses show that human milk contains less proteïd matter than was previously supposed. 100 grams of milk collected, on the average, in the second week after parturition, contain 1·52 proteïd, 3·28 fat, 6·5 sugar, 0·27 ash, 0·05 citric acid, 0·78 unknown extractives, 12·4 total dry residue. The unknown extractives, which are almost absent in cow's milk, are increased in the colostrum. W. D. H.

Composition of the Milk Fat of the Cow, the Goat, and the Reindeer. By E. Solberg (*Bied. Centr.*, 1896, **25**, 15—17; from *Tidsskr. Norsk. Landbrug*, 1895, 300—338).—The following results were obtained with the fat obtained from cheese from (1) goat's milk and (2) reindeer milk.

	M. p.	Solidifying. point.	Sp. gr. at 15° (average).	Sp. gr. at 100° (average).	Refract. coefficient.	Acid number (milligrams KOH).
(1)	27—38·5	24—31	0·9312	0·8669	1·4596	3·95—13·88
(2)	37—42	34—39	0·9428	0·8640	1·4647	27:60

	Saponification. number.	Hehner's number.	Reichert's number.	Iodine number.	Lecithin per cent.
(1)	221·6	86·46—87·34	23·1—25·4	30·4—34·6	0·1—0·2
(2)	219·2	86·89	31·4	25·1	0·21

Goat's milk fat resembles cow's milk fat a good deal, but the former contains more insoluble volatile acids than the latter. In reindeer milk fat, the amount of insoluble volatile acids is much less. N. H. J. M.

Excretion of Ammonia in Disease. By THEODOR RUMPF (*Virchow's Archiv*, 1896, **143**, 1—41).—In a number of cases of infective disease (pneumonia, typhoid, influenza, cholera, &c.), the amount of ammonia excreted in the urine, as such, is increased. The normal amount of nitrogen in the form of ammonia in the 24 hours' urine is given as varying from 0·4 to 1 gram. In the cases of disease examined, it varied from 0·8 to 6 grams. This condition passes off in an early stage of convalescence. The total nitrogen excreted is not similarly increased. On the average, there is an increase of 37 per cent. in the proportion of ammoniacal nitrogen to total nitrogen. The increase cannot be attributed to change of diet, but is explained as the result of the activity of micro-organisms. In cultures, addition of the bacilli of cholera and of other diseases causes a formation of ammonia. W. D. H.

Excretion of Ammonia in Disease. By E. HALLERVORDEN (*Virchow's Archiv*, 1896, **143**, 705—706).—A criticism of Rumpf's conclusions (preceding abstract). The ammonia produced by bacteria would be converted into urea. Ammonia has, above all, in the body, the function of an acid neutraliser; this is entirely neglected by Rumpf, who gives no estimations of acidity. The cause of the apparent increase of ammonia is doubtless to be sought in the alteration in the amount of acids produced by the fever. W. D. H.

Uric acid, Xanthine Bases, and Phosphoric acid in Human Urine. By WILLIAM CAMERER (*Zeit. Biol.*, 1896, **33**, 139—155).—Horbaczewski considers that an important source of uric acid in the urine is the xanthine bases, which are formed by the decomposition of nucleïn; phosphoric acid and proteïd are liberated at the same time. He explains the increase of uric acid after food as due to the increased decomposition of an increased number of white corpuscles (digestion leucocytosis). The present research was carried out with different diets, the ingesta and excreta (uric acid, urea, phosphoric anhydride, &c.) being analysed. The conclusion drawn, is that digestion leucocytosis is not a cause of increased excretion of uric acid, but that uric acid has two principal sources; it is a product of metabolism, and a product of the nucleïn taken in with the food, for instance, in calf's thymus (sweetbread). It is the increase or decrease of nucleïn in the food which causes a corresponding rise and fall in the uric acid secreted after a meal. W. D. H.

Excretion of Uric acid. By WILHELM EBSTEIN and ARTHUR NICOLAIER (*Virchow's Archiv*, 1896, **143**, 337—368).—Administration of uric acid to dogs, with the food, produces no appreciable effect, and it is discoverable in the fæces; in rabbits, however, which normally secrete no uric acid, intravascular, subcutaneous, and intraperitoneal injection of this substance dissolved in solution of piperazine produced the following effects. The acid was rapidly removed from the seat of injection, and in a few cases nervous symptoms (increase of reflex irritability, paralysis followed by death) were noticed. The uric acid was excreted by the kidneys; this was most markedly the case

in those animals whose kidneys had been previously injured by the administration of aloïn, and here the acid was excreted in the form of sphæroliths. The excretion of this foreign substance caused a chronic nephritis in the kidneys of the healthy rabbits experimented with.
W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

The Processes of Germination. By Dm. Prianischnikoff (*Landw. Versuchs-Stat.*, 1896, **46**, 459—470; compare Abstr., 1895, ii, 124).—Seedlings of *Vicia Faba*, 10 days old, were kept for 10 days longer in (1) 10 per cent. glycerol solution, in (2) 10 per cent. sugar, and (3) in water, respectively. Each solution contained also potassium phosphate, and calcium and magnesium sulphates. The presence of sugar soon began to hinder growth; in glycerol solution, the plants grew, but much less than in water. Sugar caused a distinct deposition of starch, whilst in glycerol, the starch production was very slight. In the plants grown in water, starch was detected in traces. Growth and deposition of starch thus vary inversely. The following analytical results are given, showing the changes in the amounts of nitrogenous constituents of the seedlings.

	Nitrogen in dry substance.			
	Total.	As proteïds.	As amides.	As asparagine.
10 days in water	4·89	2·72	2·20	1·00
10 days in water and 10 days in sugar solution..	4·92	2·65	2·37	1·10
20 days in water	5·73	2·66	3·15	1·68

There was therefore no regeneration of asparagine, and it is very probable that asparagine is never regenerated in the dark. This was the view held by Boussingault, who looked on asparagine (in etiolated seedlings) as a product of oxidation of albumin, like urea in the animal organism (compare O. Müller, Abstr., 1887, 70).

It is not yet certain whether carbohydrates are formed in the decomposition of proteïds; if they are formed, it is probable that they are products of hydration and not of oxidation.

The following calculations show the changes in 100 grams of seed (*Vicia sativa*) in germinating. The amount of ash was 3·27 per cent.

	Proteïds.	Asparagine.	Amido-acids.	Organic bases.	Starch.	Soluble carbohydrates.
0 days..	28·50	(0·32)	(2·52)	2·25	37·82	5·59
10 „ ..	15·28	5·54	7·63	3·52	17·44	8·75
20 „ ..	10·60	7·86	10·19	2·62	9·93	7·67
30 „ ..	8·84	8·77	10·90	1·55	3·94	6·27
40 „ ..	8·86	9·92	10·57	1·50	2·59	4·05

	Ether extract.	Crude fibre.	Hemi-celluloses.	Loss of weight.	Not determined.
0 days..	0·80	6·64	4·70	0	7·59
10 „ ..	1·31	7·70	5·25	15·98	8·33
20 „ ..	1·20	9·15	5·80	24·26	7·45
30 „ ..	1·11	9·65	6·10	30·86	8·74
40 „ ..	1·07	10·98	6·40	34·09	6·70

The numbers for amido-acids were obtained by multiplying the nitrogen of the phosphotungstic acid precipitate by a coefficient corresponding with the mean between those of leucine and amidovaleric acids. Choline was assumed to be the only organic base.

N. H. J. M.

Nitrogen Assimilation by Plants. By J. H. Aeby (*Landw. Versuchs-Stat.*, 1896, **46**, 410—439).—Peas and mustard were grown in zinc, funnel-shaped vessels (25 cm. in diameter at the top and 20 cm. high), being kept under glass during rain. Two kinds of soil were employed: (1) garden soil (N = 0·4051 per cent.), and (2) loamy arable soil (two years with peas; N = 0·0688 and 0·0783 per cent.). The following were the experiments (with both soils): (1) fallow, (2) peas, (3) white mustard; (4), (5), and (6) same as (1), (2), and (3), respectively, but manured with calcium nitrate (N = 2 grams). In each experiment there were three or four pots each containing 4 kilograms of soil. The numerical results (averages in grams) are given in the table, p. 382.

As regards the experiments in garden soil, the mustard germinated well, but soon left off growing in the unmanured pot. The peas (in absence of nitrate) also showed signs of nitrogen hunger, but soon recovered. In arable soil, similar results were obtained. In both soils, and without application of nitrate, the peas grew luxuriantly, owing to nitrogen fixation by nodule bacteria; in garden soil (4 kilograms), 1·799 gram of nitrogen was gained, and in arable soil, 2·373 grams. Mustard, on the other hand, developed well only when supplied with nitrate, and in no case, even in presence of pea bacteria, was there any gain of nitrogen. The results of the experiments show very clearly the difference between the two plants, and the inability of mustard to fix free nitrogen, and are, therefore, opposed to those obtained by Liebscher (Abstr., 1894, ii, 201). Pfeiffer and Francke (Abstr., 1895, ii, 521) and Nobbe and Hiltner also concluded that white mustard does not utilise elementary nitrogen.

The methods employed and the analytical data are given in full.

N. H. J. M.

A Diastatic Ferment in the Sugar-beet (Beta vulgaris). By M. Gonnermann (*Chem. Zeit.*, 1895, **19**, 1806).—Germinating and frozen beets were crushed to a fine pulp and shaken with water. The aqueous extract was then filtered, and precautions were taken to destroy all fermentative organisms; soluble calcium and lead salts were added, and precipitated by means of soda, in the hope of thus carrying down any enzymes present. The precipitates were separated by filtration, acidified with dilute acetic acid, and the solution thrown into 95 per cent. alcohol, and the precipitate produced was filtered

	Dry produce (including roots).	Nitrogen.								
		In soil at commencement.	In seeds.	Total initial.	In soil at conclusion.			In produce.	Total final.	Gain or loss.
					As nitrate.	Organic.	Total.			
In garden soil. (N = 0·4051 per cent.).										
1. Fallow..........	—	13·286	—	13·286	0·303	12·694	12·997	—	12·997	−0·289
2. Peas...........	105·0	„	0·263	13·549	0·0	12·699	12·699	2·826	15·525	+1·976
3. Mustard........	14·2	„	0·023	13·309	0·0	12·797	12·797	0·260	13·057	−0·252
4. Fallow..........	—	„	—	15·286*	2·132	12·902	15·034	—	15·034	−0·252
5. Peas...........	139·9	„	0·255	15·541*	0·355	13·043	13·398	3·764	17·162	+1·621
6. Mustard........	91·1	„	0·023	15·309*	0·0	12·905	12·905	2·065	14·970	−0·339
In arable loam. (N = 0·0688 per cent.).										
1. Fallow..........	—	3·106	—	3·106	0·077	2·897	2·974	—	2·974	−0·132
2. Peas...........	105·0	2·831	0·265	3·078	0·0	3·072	3·072	2·765	5·837	+2·759
3. Mustard........	3·2	3·106	0·023	3·129	0·0	3·040	3·040	0·061	3·101	−0·028
4. Fallow..........	—	3·106	—	5·106*	2·019	2·890	4·909	—	4·909	−0·197
5. Peas...........	148·8	2·831	0·265	5·078*	0·061	3·144	3·205	3·860	7·065	+1·987
6. Mustard........	75·7	3·106	0·023	5·129*	0·0	3·192	3·192	1·787	4·979	−0·150

* Including 2 grams as calcium nitrate.

off, dried at 38°, and extracted with glycerol. The following facts show, beyond question, that the glycerol extract contained an enzyme.

When added to starch-paste, maintained at 38° for six hours, the presence of a reducing substance was detected; a similar experiment, carried out without the addition of the extract, showing no such result. Further experiments proved that amylodextrin could be converted into dextrose by digestion with the glycerol extract during half an hour. A. L.

Occurrence of Arginine in the Tubers and Roots of certain Plants. By ERNST SCHULZE (*Ber.*, 1896, **29**, 352—354).—Arginine (compare Abstr., 1886, 725) occurs in the tubers of the turnip (*Brassica rapa*), and of the artichoke (*Helianthus tuberosus*), and in the roots of *Ptelea trifoliata*. It is probably also contained in the roots of chicory. Dried turnips contain only 0·18 per cent. of arginine.

Arginine (from *Lupinus luteus*) was found to have no physiological action on animals. C. F. B.

Coloration of the Tissues, and Juice of certain Fungi when exposed to Air. By EMILE E. BOURQUELOT and GABRIEL BERTRAND (*J. Pharm.*, 1896, [6], 3, 177—182).—The juice of various species of Boletus becomes coloured when exposed to air; this is due to the action of an oxidising ferment. Specimens of *B. cyanescens* are finely divided, with as little exposure to air as possible, and extracted with boiling alcohol (95 per cent.); the ferment is destroyed and the solution can be kept for an indefinite period without undergoing change, even when diluted with water or exposed to air; but when a fragment of *Russula cyanoxantha* or *R. furcata* is introduced into the alcoholic solution, diluted with an equal volume of water, the liquid rapidly turns blue, from the surface downwards; the same change is produced, as in the case of guaiacum tincture, by various oxidising agents, such as ferric chloride, sodium hypochlorite, and lead peroxide; the colour is destroyed by acids, with the exception of acetic, and by alkalis. The analogous compound from *R. nigricans* is insoluble in alcohol; it is prepared by treating the finely divided fungus with alcohol and extracting the residue with hot water; the solution is filtered hot, and, when cold, the compound crystallises in colourless, microscopic needles; in presence of the ferment, it gives first a purple, then an inky-black, solution, but the colour is not produced by ordinary oxidising agents. J. B. T.

Composition of Medlars. By WILHELM BERSCH (*Landw. Versuchs-Stat.*, 1896, **46**, 471—473).—The fruit of the common medlar (*Mespilus germanica*) has the following composition (per cent. in dry matter, p. 384).

The amounts of dry matter in the fresh substance are (1) 30·87, (2) 36·86, (3) 24·79, and (4) 61·58 per cent.

The fruit contains malic acid, acetic acid (0·03 per cent.), and alcohol.

	Proteïn.	Fat.	Sugar.	N-free extract.	Crude fibre.	Ash.
1. Whole fruit..	2·79	1·04	36·08	40·98	16·29	2·82
2. Skin........	4·12	2·66	—	72·62	17·51	3·09
3. Flesh	2·62	0·57	48·56	37·63	7·35	3·27
4. Stones	2·55	0·62	—	46·66	48·52	1·65

N. H. J. M.

Composition of Different Melons. By Wilhelm Bersch (*Landw. Versuchs-Stat.*, 1896, **46**, 473—476).—The whole fruit (1) and the fruit flesh (2) of the different melons examined contained the following amounts of dry matter. Sugar melons (1) 7·148, (2) 4·850; Persican melons (1) 6·130, (2) 4·100; water melons (1) 6·56, (2) 6·31 per cent. The percentage composition of the dry matter is as follows.

		Proteïn.	Fat.	Dextrose.	N-free extract.	Crude fibre.	Ash.
Sugar melon ..	(1)	22·250	6·728	36·320	12·970	14·890	6·842
	(2)	13·394	1·694	70·632	0·289	6·897	7·094
Persican melon	(1)	20·710	13·140	30·180	4·485	21·550	9·935
	(2)	11·800	1·854	65·850	3·439	8·439	8·618
Water melon ..	(1)	13·740	6·890	37·360	21·740	15·410	4·860
	(2)	9·731	1·062	66·730	16·946	1·949	3·582

The sugar occurred entirely as dextrose. N. H. J. M.

The Potash and Phosphoric acid required by Cultivated Plants. By Smets and C. Schreiber (*Bied. Centr.*, 1895, **24**, 805—808; from *Recherches sur les besoins potas. et phosphat. des plantes cult. Masseyk.*, 1894; compare this vol., ii, 68).—The following numbers show the relative requirements for potash and phosphoric acid of the different plants.

	K_2O.	P_2O_5.		K_2O.	P_2O_5.
Holcus lanatus	16	40	Secale	39	70
Phleum pratense	18	58	*Vicia sativa*	46	79
Avenor elatior........	18	51	Lucerne	51	70
Beta vulgaris	23	64	*Trifolium pratense*	53	74
Hordeum vulgare	24	71	Maize................	55	74
Triticum spelta.......	27	54	*Setaria german.*	56	47
Lolium ital.	28	49	*Ornithopus*	56	64
Fagopyrum esculentum.	29	45	*Trifolium repens*	63	76
Faba vulgaris........	32	65	*Daucus carota*	64	74
Pisum sativum	34	61	*Cannabis sativa*	65	81
Spergula arvensis....	38	52	*Trifolium incarnatum*	73	68

Greater differences are shown in the requirements for potash than for phosphoric acid. The gramineous plants require the least potash. N. H. J. M.

Analytical Chemistry.

A Gas Pipette of Simple Construction. By Alexander P. Lidoff (*J. Russ. Chem. Soc.*, 1894, **26**, 37—39).—This apparatus consists of a short glass beaker of about 400 c.c. capacity, into which the absorption liquid is poured, and a funnel of 150 c.c. capacity put upside down into the beaker. The upper part of the funnel is blown into a small bulb, and a capillary tube fused on to it. A mark is made on the capillary tube, and the tube closed by a piece of india-rubber tubing and a Mohr's clip, connected with a graduated pipette. To increase the absorption of the gas by the liquid, 7—8 grams of asbestos or glass wool are placed in the beaker under the funnel. A copper or lead ring of about 10 grams weight is placed on the funnel to prevent its rising when filled with gas.

To protect the reagent from atmospheric action, a thin layer of paraffin oil, sp. gr. 0·875, is poured on it. The author claims that a perfect isolation of the reagent is thus effected.

This pipette is worked exactly like Hempel's, namely, the india-rubber tube of the pipette, which is filled up with the liquid to the mark, is connected by means of a bent capillary tube with the gas burette, the gas from the burette pressed into the pipette, and the latter closed with the Mohr's clip.

The shaking of the ordinary gas pipette is in this case replaced by moving the funnel up and down in the liquid.

A further advantage of this apparatus is the possibility of heating the absorbent in the beaker if necessary. S. G. R.

A New Cyanometric Method and its Applications. By Georges Denigès (*Ann. Chim. Phys.*, 1895, [7], **6**, 381—428).—The author first, from thermochemical considerations, concludes that the addition of an alkali chloride as an indicator in the Liebig estimation of cyanides can be of no advantage; he then shows by actual experiment that this is so, as the permanent precipitate which is formed always consists of silver cyanide, and not of silver chloride. If an alkali bromide is added, the precipitate formed consists of silver cyanide with a little silver bromide.

The author's method consists in using 10 drops of a 20 per cent. potassium iodide solution as an indicator, in a medium which has been rendered strongly alkaline with ammonia. The silver cyanide is readily soluble in ammonia, whereas silver iodide is not. N/10 silver nitrate is therefore run into the solution until a slight permanent precipitate is formed. The calculation is the same as in the usual Liebig titration, two molecules of potassium cyanide reacting with one of silver nitrate. The amount of ammonia present has but little influence on the reaction; sodium carbonate also, or moderate quantities of alcohol do not interfere with the titration. Cherry laurel water can also be titrated in a similar manner; in this case, however, it is necessary to add a few c.c. of caustic soda or potash before the ammonia. If this precaution is not taken, the amount of cyanide found varies with the length of time during which the mixture is allowed to remain (compare Gregor, Abstr., 1894, ii, 165). This result is no doubt due to the condensation, in the presence of ammonia, of part of the hydrocyanic acid with the benzaldehyde, which also occurs in the distillate.

The method can also be used for the estimation of alkali cyanides and cyanides which are decomposed by alkalis; if these contain any sulphide, as many commercial cyanides do, it is necessary to remove the sulphide by treatment with zinc sulphate in the presence of sodium hydroxide; the excess of sulphate can be removed by lead acetate, and the filtrate then titrated, after the addition of 10 drops of the potassium iodide solution, with standard silver nitrate. Mercuric cyanide can also be titrated if it is first decomposed with sodium sulphide and the excess of sulphide removed as above.

The author recommends this method for the estimation of silver in the form of any of its salts. The silver salt is dissolved in water, ammonium hydroxide, N/10 potassium cyanide, or nitric acid, according to its solubility, a slight excess (5—10 c.c.) of ammonium hydroxide and 20 c.c. of N/10 potassium cyanide are then added, and the excess of cyanide is estimated by the method described above. The N/10 cyanide solution can be accurately prepared by titrating against N/10 silver nitrate, and the author finds that such a solution, previously rendered alkaline by ammonia, or, still better, by caustic soda, is extremely stable, and may be kept for months. To estimate silver in the presence of copper or mercury, it is better to precipitate the silver as chloride, to dissolve the well washed chloride in ammonia and N/10 potassium cyanide, and to titrate as above.

The same principles may be made use of for the estimation of chlorides in various organic liquids, such as bile, urine, gastric juice, cystic fluids, blood, milk, wine, vinegar, and other fermented liquids. In the case of bile, 20 c.c. of the bile, 2 c.c. of nitric acid, and 20 c.c. of N/10 silver nitrate are placed in a 200 c.c. flask, and made up to the mark with distilled water. After filtration, 100 c.c. of the clear filtrate is mixed with 15 c.c. of ammonia, 10 drops of the 20 per cent. potassium iodide solution, and 10 c.c. of the N/10 potassium cyanide, and then titrated back with N/10 silver nitrate. If $n =$ the number of c.c. of N/10 silver nitrate used, then $n \times 0.585$ gives the amount of chloride, expressed as sodium chloride, contained in 1 litre of the bile.

For urine, it is generally necessary to work with a less concentrated solution, and if the urine contains much proteïd matter it is advisable to warm on the water bath for 10—15 minutes before making up to the requisite volume. For blood, it is best to mix with an equal volume of a cold saturated sodium fluoride solution and 10 c.c. of pure nitric acid before dilution.

Bromides and mixtures of bromides and chlorides may be estimated in a similar manner. For the estimation of iodides, the author recommends the following method. 50 c.c. of approximately N/10 iodide solution is taken, added to 25 c.c. of ammonia, 5 c.c. of hydrochloric acid, and 50 c.c. of N/10 silver nitrate, and then made up to 250 c.c. with distilled water. Unless hydrochloric acid is added, the silver iodide is obtained in too fine a state of division to allow of filtration. 200 c.c. of the clear filtrate is added to 10 c.c. of N/10 potassium cyanide and 10 drops of the indicator (20 per cent. potassium iodide solution), and the excess of cyanide estimated in the usual way. Iodates, after conversion into iodides by treatment with sodium hydrogen sulphite, may be titrated in the same way. Many organic iodo-compounds may be treated in a similar manner; the iodine is converted into iodic and hydriodic acids by boiling for one to two minutes with a mixture of 1 c.c. of nitric acid and 2 c.c. of hydrochloric acid. The iodic acid can be reduced to hydriodic acid by means of sodium hydrogen sulphite, and then titrated as above. In certain cases, it is preferable to warm the iodo-compound with about 1 c.c. of concentrated sulphuric acid.

The same method can also be used indirectly for the estimation of xantho-uric derivatives in urine, and of theobromine in the presence of caffeïne. In both cases, the silver compounds are precipitated by means of ammoniacal silver nitrate, and the excess of silver nitrate in the filtrate is then estimated by the method already described.

The author finally recommends this method for the indirect estimation of substances which precipitate metallic silver from solutions of silver nitrate. Thus, hydrogen arsenide may be estimated by passing it into a solution of N/10 silver nitrate acidified with nitric acid, filtering off the metallic silver formed, and then estimating the amount of silver nitrate left in the filtrate after it has been rendered alkaline by ammonia. Hydroxylamine and phenylhydrazine reduce ammoniacal silver nitrate, and may therefore be estimated in a similar manner. 0·08—0·10 gram of the hydroxylamine salt, 25 c.c. of N/10 silver nitrate, 10 c.c. of ammonia, and 2 c.c. of caustic soda are placed in a 125-c.c. flask and heated to boiling; after cooling, the volume is made up to the mark with distilled water, the metallic silver is filtered off, and the excess of silver nitrate in 100 c.c. of the filtrate estimated as before. J. J. S.

[Estimation of Sulphur by combustion in Air.] By Charles F. Mabery (*Amer. Chem. J.*, 1896, 18, 149—151).—The author believes this method, which he recently described (Abstr., 1895, ii, 136), is not excelled in accuracy by any other method at present in use. It is applicable to non-volatile substances. Substances containing a high percentage of sulphur may yield sulphurous as well as sulphuric acid; in such cases a little hydrogen peroxide should be added before titrating.

Estimation of Sulphur in Illuminating Gas and in Coal. By Charles F. Mabery (*Amer. Chem. J.*, 1896, 18, 207—213).—This is a modification of a method previously described by the author (Abstr., 1895, ii, 136). The current of gas is measured by a meter, and is burnt at a constriction in a combustion tube 45·5 cm. long, having the constriction 30 cm., from the forward end. A rapid current of air is drawn through the combustion tube. The products of combustion and the excess of air are drawn through a large U-tube containing a centinormal solution of sodium hydroxide, in which the sulphuric acid is absorbed. Subsequent titration of this solution with centinormal sulphuric acid gives the amount of sulphur present in the gas. Since treatment of this solution with hydrogen peroxide in no way affected the result, the author is convinced that all the sulphur is completely oxidised to sulphuric acid by this method.

In Coal.—The coal is weighed in a platinum boat sufficiently large to contain all the ash, and placed in the forward portion of the combustion tube, air being drawn both through an inner hard-glass tube terminating at the constriction of the combustion tube, and, in a slower current, through a tube at the rear. A U-tube of considerable size is employed, and a decinormal solution of sodium hydroxide used.

Determinations conducted on the ash of several varieties of coal treated in this manner gave a mean of only 0·043 per cent. of sulphur. The combustion is, therefore, practically complete.

J. F. T.

Standardising Potassium Permanganate and Sulphuric acid. By Harmon N. Morse and A. D. Chambers (*Amer. Chem. J.*, 1896, **18**, 236—238).—It is possible, by means of a standard solution of potassium permanganate of normal composition, in the presence of a neutral reducing agent such as hydrogen peroxide, to accurately determine the strength of a dilute solution of sulphuric acid, and conversely by means of standard sulphuric acid, to standardise a solution of potassium permanganate. J. F. T.

Volumetric Estimation of Phosphorus. By Lindemann and Motteu (*Bull. Soc. Chim.*, 1896, [3], **13**, 523—533).—The phosphoric acid is separated as ammonio-manganous phosphate, and the manganese then converted into the dioxide, and estimated volumetrically.

Soluble phosphates, such as alkali phosphates, are dissolved in water (0·1 gram P_2O_5 in 50 c.c.), ammonium chloride (10 c.c. of 20 per cent. solution) and ammonia (10 c.c.) are added, and then ammonium citrate (25 c.c. of solution containing 150 grams of acid and 500 c.c. of ammonia to 1000 c.c. of water). The phosphoric acid is next precipitated by the addition of manganous sulphate (25 c.c. of 25 per cent. solution of the hydrated salt), the double salt appearing in large, nacreous, rose-coloured crystals on boiling, provided the solution is gently stirred and care taken to avoid rubbing the sides of the vessel. In the presence of ammonium citrate, the precipitation is as complete in a few minutes as in the presence of excess of phosphate, and the excess of manganese, of course, remains in solution.

The precipitate is collected and redissolved in dilute hydrochloric acid in the vessel in which it was first precipitated, and after dilution (to 250—300 c.c.), hydrogen peroxide is added in amount (1—4 c.c.) proportional to the amount of the precipitate; the solution is then made alkaline with potash (20 c.c. of 10 per cent. solution), and boiled for 10 minutes to expel the excess of hydrogen peroxide. When cold, the precipitated manganese dioxide is redissolved in hydrochloric acid (20 c.c. of 20 per cent. acid), and after a short interval, excess of potassium iodide (20 c.c. of 10 per cent. solution) is added.

Finally, the iodide thus liberated is titrated with N/20 sodium thiosulphate, of which 1 c.c. = 0·0023 gram P_2O_5. A correction of 4 milligrams must be added to the amount of phosphoric anhydride found, to allow for the slight solubility of the ammonio-manganous phosphate in the reagents.

Insoluble phosphates are first dissolved in acids in the usual way and precipitated with ammonium molybdate, the precipitated phosphomolybdate being then redissolved in dilute ammonia (10 c.c. to 50 c.c. of water), and treated in the same way as a soluble phosphate.

JN. W.

The Molybdic Reagent. By G. MEILLÈRE (*J. Pharm.*, 1896, **3**, 61—62).—This reagent is prepared by mixing ammonium molybdate solution (15 per cent., 200 c.c.) with sulphuric acid (1 : 1, 20 c.c.), and adding concentrated nitric acid (30 c.c.). The reagent is very sensitive, can be heated at 100° for a short time without decomposition, and may even be employed for the direct estimation of phosphoric acid. In this case, the precipitate is gently warmed, allowed to remain during 12 hours, and then washed with a little saturated solution of ammonium nitrate; under these conditions, molybdic acid is only deposited in traces, and unless a high degree of accuracy is required, it is unnecessary to subsequently employ magnesia mixture and ammonium citrate.

Arsenic acid is precipitated less readily than phosphoric acid, and the precipitate is less homogeneous on account of the more prolonged heating which is required; the precipitate is redissolved, and precipitated by means of magnesia mixture in presence of ammonium citrate; the presence of tartrates is undesirable, as they retard the deposition of the arsenate. J. B. T.

Estimation of Phosphorus in Iron and Iron Ores containing Titanium. By JOHN PATTINSON and HUGH S. PATTINSON (*J. Soc. Chem. Ind.*, 1895, **14**, 443—444).—The authors have noticed that the formation of the yellow molybdic precipitate is seriously interfered with by the presence of titanic acid, and that this substance must, therefore, be first removed.

This is best effected by a method communicated to the authors by Stead. The iron is first reduced, as usual, to the ferrous state, and enough alum is then added to combine with all the phosphoric acid, and in this way aluminium phosphate is precipitated instead of the iron compound; this is then fused with sodium carbonate and extracted with water, which will leave any sodium titanate insoluble. The solution contains all the phosphoric acid, which is estimated in the usual manner. L. DE K.

Application of the Citrate Process to Wagner's Method for the Estimation of Citrate Soluble Phosphoric acid in Basic Slags. By F. MACH and MAX PASSON (*Zeit. angw. Chem.*, 1896, 129).—To avoid the troublesome molybdate separation, the authors operate as follows: 100 c.c. of Wagner's solution is boiled in a half-litre flask with a very long narrow neck, with 10 c.c. of sulphuric acid, 15 c.c. of strong nitric acid, and a drop of mercury until the liquid has become quite colourless. After cooling, 20 c.c. of a 10 per cent. sodium chloride solution is added to precipitate the mercury, the mixture is diluted to 200 c.c., and 100 c.c. of the filtrate is mixed with 100 c.c. of the conventional ammonium citrate solution. After cooling, 25 c.c. of magnesium mixture is added to precipitate the phosphoric acid.

L. DE K.

Detection of Chromates and Arsenates. By UBALDO ANTONY (*Gazzetta*, 1895, **25**, ii, 407—408).—The author criticises Tarugi's remarks (this vol., ii, 340) respecting Tassinari and Antony's book on qualitative analysis and the detection of arsenates in presence of chromates.

W. J. P.

Estimation of Arsenic in Crude Sulphuric acid. By GEORG HATTENSAUR (*Zeit. angw. Chem.*, 1896, 130—131).—Five hundred c.c. of the sample is diluted with 500 c.c. of water, and, after cooling, 500 c.c. of dilute hydrochloric acid (1—2) is added. This prevents the precipitation of lead sulphate, and also the subsequent formation of lead sulphide.

The arsenic is now precipitated by a current of hydrogen sulphide, and is collected on a weighed filter and weighed as sulphide. If the amount is not too small, it may also be converted, in the usual way, into magnesium pyroarsenate and weighed as such.

L. DE K.

Estimation of Arsenic in Iron Ores, Steel, and Pig-Iron. By JOHN E. STEAD (*J. Soc. Chem. Ind.*, 1895, **14**, 444—446).—The steel is dissolved in dilute hydrochloric acid, and the gas evolved is passed through bromine water (or through a solution of silver sulphate), the apparatus being fitted with a potash tube to prevent escape of bromine vapours. The potash solution is afterwards acidified with hydrochloric acid and added to the bromine water, which is boiled until colourless and then added to the iron solution in the flask; if silver sulphate has been used, it is first precipitated with hydrochloric acid, and then added to the iron solution.

The liquid is now mixed with about half a gram of zinc sulphide, which soon causes a precipitate containing all the arsenic. This is collected, dissolved in bromine water, and after boiling off any excess of bromine, it is put into a retort and distilled with ferrous chloride and hydrochloric acid; to ensure the complete expulsion of the arsenic, however, it is necessary to distil a few times with fresh hydrochloric acid. If there are not many samples to test, the precipitation as sulphide may be omitted, and the liquid at once distilled to dryness. The distillate is neutralised with ammonia, again slightly acidified with hydrochloric acid, mixed with a slight excess of sodium carbonate, and then titrated with a weak standard solution of iodine, using starch as indicator.

Pig-iron is treated in the same manner, omitting the precipitation as sulphide. Iron ores are simply distilled with hydrochloric acid and ferrous chloride.

L. DE K.

Estimation of Free and Combined Carbonic Anhydride in Carbonated Waters (Vichy-Vals). By G. MEILLÈRE (*J. Pharm.*, 1896, [6], **3**, 6—8).—To estimate the total carbonic anhydride, the water under examination is mixed with an equal volume of baryta water of known content. Waters rich in carbonic anhydride are siphoned as completely as possible from the bottle to the bottom of the vessel containing the baryta water, and the bottle is then rinsed with baryta solution, care being taken to avoid loss of gas. An aliquot part of the liquid is filtered and titrated with normal acid, using tropæolin as an indicator; this gives the total carbonic anhydride. For the combined carbonic anhydride, the original water is titrated directly with acid and tropæolin. The method gives very satisfactory results, and is much more readily carried out than one based on the extraction of the gas under reduced pressure. J. B. T.

Exclusion of Ammonium Sulphide from Qualitative Analysis. By N. TARUGI (*Gazzetta*, 1895, **25**, ii, 478—481).—In order to avoid the inconveniences attending the use of ammonium sulphide in precipitating the metals of the fourth group in qualitative analysis, the author proposes to replace it by ammonium ferricyanide. The filtrate from the precipitate obtained with ammonia and ammonium chloride is boiled, slightly acidified with hydrochloric acid, a slight excess of ammonium ferricyanide added, and the liquid heated; the precipitate (A) contains the cobalt, nickel, and manganese as ferricyanides insoluble in dilute hydrochloric acid. The filtrate is treated with ammonia and ammonium carbonate, and the precipitate (B) containing only carbonates of barium, strontium, and calcium is filtered off. Ammonium phosphate is then added to the filtrate, and the precipitate (C), containing all the magnesium, separated; if a yellowish precipitate is obtained on adding acetic acid to the filtrate from C, it can only consist of zinc ferricyanide. The filtrate can be dried and heated to redness, and the residue examined for the alkali metals in the usual way.

The precipitate A is shaken with cold ammonia and filtered; if the filtrate gives a yellowish precipitate or turbidity on acidifying with hydrochloric acid, nickel is present, the ferricyanide of this metal being insoluble in hydrochloric acid but very soluble in ammonia. The residue left on the filter may contain manganese and cobalt; the presence of the former may be detected by heating with lead dioxide and nitric acid and examining for permanganic acid, or by fusing a part of the precipitate with potassium nitrate and carbonate on a platinum spatula, and observing if a green colour is produced; cobalt may be detected by examining in a bead in the reducing flame. A very delicate test for the presence of cobalt and manganese in the precipitate left after extracting the nickel as above, consists in drying it, heating to redness, and repeatedly extracting the residue with very dilute hydrochloric acid until it is no longer coloured yellow. The residue is then boiled with concentrated hydrochloric acid, and the solution evaporated to dryness, dissolved in water, and potassium cyanide added until re-solution of the precipitate occurs; a few drops of potassium nitrite and one drop of nitric acid are then added; if the solution contains a trace of cobalt, it becomes tinted rose colour, but if manganese alone is present, a greenish precipitate is formed, whilst the solution remains colourless. If both metals are present, both coloration and turbidity occur together.

The precipitate B is examined in the usual way for barium, strontium, and calcium, and the presence of magnesium in C is also confirmed by the ordinary method. W. J. P.

Estimation of Alkali Salts in Fireclays, Manures, &c. By Alexander Cameron (*J. Soc. Chem. Ind.*, 1895, **14**, 427—428).—The author has proved by several experiments that the barium hydroxide process is thoroughly trustworthy for the estimation of alkalis in manures, even in the presence of magnesia. The sulphate and carbonate methods may also be successfully employed, but the chloride method, on account of its troublesome nature and untrustworthy results, cannot be recommended. L. de K.

The Testing of Hydraulic Cements. By W. Harry Stanger and Bertram Blount (*J. Soc. Chem. Ind.*, 1894, **13**, 455—461).—The authors state that a chemical analysis alone is not sufficient to judge the quality of a sample of cement, but that several mechanical tests should be applied.

As regards the fineness, it has been recently recognised that the coarser particles of a hydraulic cement, at least, all that remain on a sieve having 76 meshes per linear inch, are wholly inert, or so slow in setting as to be practically useless. Good cement should not contain more than 10 per cent. of such coarse matter. The weight per unit measure is often, but erroneously, confused with the specific gravity of the sample, but that there is no connection between the two will be seen from the fact that a bushel of good cement weighs from 108—110 lbs., corresponding with an apparent specific gravity of 1·37, whilst the true specific gravity is about 3·15. As regards the well known test of tension and compression, the authors remark that the best cement may be rendered useless by admixture with bad sand and aggregate. Deval's hot process for the testing of soundness is considered to be too severe. The time of setting is much influenced by the temperature, being shorter as the latter increases, although there appears to be no definite relation. Finally, the authors point out that in the chemical analysis no good process for the estimation of free lime exists as yet, and that analyses showing over 1 per cent. of this substance should be received with caution. The hydraulic cements are themselves decomposed by water, and yield a liquid containing free lime. L. de K.

Colorimetric Estimation of Iron. By Georg Lunge (*Zeit. angw. Chem.*, 1896, 3—5).—The process is chiefly devised for the estimation of traces of iron in commercial aluminium sulphate. The reagents are a 10 per cent. solution of potassium thiocyanate, pure ether, and a solution of 8·606 grams of ammonium iron alum in a litre of water; this solution must be diluted to 10 times its volume immediately before use.

One or two grams of the sample is dissolved in a little water and heated for a few minutes with 1 c.c. of nitric acid free from iron; after cooling, the solution is made up to 50 c.c. 5 c.c. is then introduced into one of a set of glass stoppered cylinders, marked 25 c.c., and divided to 0·1 c.c., with plenty of room for shaking. 5 c.c. of dilute nitric acid (1 in 50) is put into a second cylinder, and, say, 1 c.c. of the iron solution is added; into the first cylinder a quantity of water equal to the iron solution in the second should then be introduced. Both liquids are now mixed with 5 c.c. of the thiocyanate solution; they both turn reddish, but the colour is no criterion of the relative amount of iron. 10 c.c. of ether is now added, and both tubes are thoroughly shaken, when a great difference in the colour of the ethereal layers will at once tell whether too much or too little iron solution has been added. The experiment is then repeated, using four tubes, and introducing slightly different amounts of iron solution in each. The comparison of the colours should not be attempted until a few hours have elapsed. The test is capable of showing with certainty 0·000001 gram of iron. L. DE K.

Analysis of Used Liquors in Chrome Tannage. By CARLTON B. HEAL and HENRY R. PROCTER (*J. Soc. Chem. Ind.*, 1895, **14**, 248—252).—The authors have investigated the action of skins on the solution of potassium dichromate, known as the dichromate bath, and also their behaviour in the hypo-bath (solution of sodium thiosulphate), and have tabulated the results.

The amount of free chromic acid in the dichromate bath may from time to time be titrated by adding a few drops of solution of 5 per cent. copper sulphate, boiling and running in standard soda until a brownish precipitate of basic copper chromate forms. This method, although not well adapted for turbid liquors, is nevertheless better than the hydrogen peroxide ether process, and can be used with artificial light. Titration with standard thiosulphate, using potassium iodide and a little hydrochloric acid in the chrome solution, and starch as indicator, also gives good results. L. DE K.

Estimation of Pentoses and Pentosans by the Furfuraldehyde Distillation Process. By F. MANN, M. KRÜGER, and BERNHARD TOLLENS (*Zeit. angw. Chem.*, 1896, 33—46).—The first part of the paper by MANN and TOLLENS is devoted to an exhaustive examination of the phenylhydrazine method for estimating furfuraldehyde (Abstr., 1893, ii, 52). The authors come practically to the same conclusions as Flint and Tollens, and also confirm the statement of Günther and others that furfuraldehyde is produced on distilling glycuronic acid or its derivatives with hydrochloric acid, although these compounds do not belong to the true pentoses (Abstr., 1895, ii, 335). Experiments to increase the yield of furfuraldehyde by the addition of stannous chloride, or by substituting phosphoric for hydrochloric acid, were not successful.

The second part of the paper by KRÜGER and TOLLENS is an exhaustive study of the method proposed by Councler (Abstr., 1895, ii, 144), which involves the use of phloroglucinol. This process seems to be preferable to the phenylhydrazine method, as it is not necessary to neutralise the distillate. L. DE K.

Hydrolysis and Estimation of Sugar. By JAMES O'SULLIVAN (*J. Soc. Chem. Ind.*, 1895, **14**, 555—556).—See this vol., i, 334.

Specific Gravity of Milk-serum; Estimation of Lactose in Milk. By ED. VON RAUMER and ED. SPAETH (*Zeit. angw. Chem.*, 1896, 46—49; 70—73).—Two hundred c.c. of the sample is put into a beaker with a glass rod, and the whole carefully counterpoised on a balance capable of showing about 0·005 gram. After adding 2 c.c. of 20 per cent. acetic acid, the beaker is placed in boiling water for half an hour, and when cold, the loss in weight is carefully compensated by dropping in water from a pipette. After thoroughly mixing, the liquid is filtered through a folded filter, the first few c.c. which generally run through turbid being returned to the filter; if the filtrate cannot be obtained clear, a weighed portion of it must be heated again in a covered beaker, and the slight loss made good by adding a very thin alumina cream. A perfectly clear filtrate can then always be obtained.

A large number of experiments tabulated by the authors show that the sp. gr. of normal milk-serum varies from 1·026—1·033. As regards the estimation of the lactose, the authors recommend the gravimetric process of Soxhlet-Allihn, after clearing the milk, or its serum, by means of copper sulphate and aqueous potash. Estimation by means of the polariscope is not to be recommended, for although some of the results corresponded very well with those obtained by the copper process, some milks appear to contain a small quantity of a dextrin-like substance, which utterly upsets polarimetric observations. The amount of lactose in normal milk varies from 4·25 to 5·20 per cent. L. DE K.

Polarisation and Analysis of Black Beers, Worts, and Caramel. By JOHN HERON (*J. Fed. Inst. Brewing*, 1895, **1**, 110—116).—The chief point in this paper is the method advocated for determining the rotatory power of black beers, worts, and solutions of caramel. For this purpose, 25 c.c. of the liquid is introduced into a 50-c.c. measuring flask and 5 c.c. of bleach solution added; when the liquid has become decolorised, which occurs in about five minutes, it is made up to bulk and filtered. Its rotatory power is then determined and multiplied by 2 to correct for dilution. Several experiments are described showing that bleaching liquor in the proportion recommended has no influence on the rotation of the more commonly occurring carbohydrates.

The method, sometimes advocated, of diluting black beers to 10 times their volume for taking their rotation, is condemned by the author as inaccurate. A. K. M.

The Analysis of Beer, with some Remarks on the Unfermentable Reducing Residue. By G. HARRIS MORRIS (*J. Fed. Inst. Brewing*, 1895, **1**, 125—139).—The recognition of the fact that beer contains an unfermentable residue which reduces Fehling's solution has necessitated some modification of the methods of analysis. The results obtained by the method described are expressed as percentages on the original wort solids and in the following terms. Matter fermented, low type maltodextrins (calculated as maltose), combined maltose and combined dextrin (constituting the normal maltodextrins), free dextrin, unfermentable reducing residue (calculated as maltose), and undetermined matter (by difference).

In order to carry out these determinations, 200 c.c. of the beer is evaporated to about one-half to expel the alcohol, and the residue made up to the original bulk; different portions are then treated as described under (*a*), (*b*), and (*c*).

(*a*) *Degradation with Cold Malt Extract.*—50 c.c. is digested for one hour at 55° with 2·5 c.c. of cold-water malt extract; it is then boiled, cooled, made up to 100 c.c., and filtered. Its reducing and rotatory powers are then determined in the ordinary way. A blank experiment with malt extract is also made and applied as a correction. (*b*) *Fermentation.*—In order to determine the low type maltodextrins, another portion of the residue (50 c.c.) is fermented with about 0·25 gram of pressed yeast at 20°. After about 72 hours, fermentation will have ceased, and the liquid is then cooled, a little alumina added, and the whole made up to 100 c.c.; it is then filtered and the reducing power determined. (*c*) *Fermentation in the Presence of Cold-water Malt Extract.*—Another 50 c.c. is fermented as under (*b*), but with the addition of 2·5 c.c. of cold-water malt extract, and both the reducing and rotatory powers of the product are estimated, these being corrected by means of a control experiment with the cold-water malt extract.

In calculating the results, the low type maltodextrins are arrived at by deducting the reducing power (expressed as CuO) obtained under (*b*) from the original reducing power of the beer and calculating the difference into maltose. The combined maltose is obtained by deducting the reducing power found from (*c*) from that given by (*b*). The increase in the reducing power after degradation with malt extract gives the combined dextrin, whilst the free dextrin is calculated from the rotation after degradation minus that due to the total maltose and the unfermentable residue. Finally, the reducing power given by (*c*) is calculated as maltose and expressed as unfermentable residue. The other determinations are carried out in the usual way, and need no description. A. K. M.

Estimation of the Dry Substance in Malt Wort and Beer. By H. Elion (*J. Fed. Inst. Brewing*, 1895, **1**, 23—28).—The method devised by the author depends on the use of dry air under diminished pressure and at a temperature of 97°, and may be used for determining the dry matter in wort, beer, yeast, malt, barley, sugar, &c. The apparatus consists of a jacketed cylinder arranged horizontally, and which can be heated either by steam or boiling water. The air within the cylinder is reduced to 40—50 mm. pressure, and a little air dried by sulphuric acid is then admitted. The material to be dried is placed in short, wide, cylindrical weighing bottles fitted with stoppers.

Results are given showing that the method compares favourably with those in which an absorbent material such as chrysotile or blotting paper is made use of. A. K. M.

Estimation of the Extract of Malt. By ARTHUR L. STERN (*J. Fed. Inst. Brewing*, 1895, **1**, 448—450).—Two similar quantities (50 grams each) of ground malt are mashed in the usual way and then cooled. About 150 c.c. of water is added to one of the mashes, and both are weighed, the difference being the weight of the added water. The two products are then filtered, and from the specific gravities of the two filtrates the extract yielded by the malt can be calculated. For this purpose, the following formula is made use of.

$$V = \frac{SG'' - 1}{SG' - SG''} \times A, \text{ in which}$$

SG′ is the specific gravity of the solution before dilution.
SG″ „ „ „ after „
V is the volume of the solution before dilution.
A „ weight or volume of the water added.

From the volume and specific gravity of the undiluted mash, the extract is calculated in the usual way. A. K. M.

Estimation of Alkali Benzoates. By G. REBIÈRE (*J. Pharm.*, 1896, [6], **3**, 113—116).—The base is estimated by adding to the substance hydrochloric acid in excess, heating on the water bath until all free acid is removed, and titrating the residual chloride by means of N/10 silver nitrate solution. The benzoic acid is determined in a second and equal portion, which is dissolved in water (50—60 c.c.), and sulphuric acid (N/10) added, in the exact quantity needed to combine with the metal; the liberated benzoic acid is then titrated with soda (N/10), phenolphthaleïn being used as indicator. With normal benzoates, the quantity of soda required is equal to that of the sulphuric acid employed, whilst with basic and acid salts, it is less and more, respectively. After proving the accuracy of this method, the author investigated the composition of various benzoates employed in pharmacy. Sodium benzoate crystallises with $1H_2O$, and is usually tolerably pure, the potassium salt contains $3H_2O$, and generally has an acid reaction, the lithium salt contains $1H_2O$, its analysis requires care to avoid loss of lithium chloride, whilst the ammonium salt is anhydrous; the ammonia is estimated by boiling with excess of the above soda solution, and titrating with sulphuric acid.

J. B. T.

Estimation of Parasulphanilic acid. By KARL BRENZINGER (*Zeit. angw. Chem.*, 1896, 131—133).—The process is based on the fact that the para-acid when treated with bromine water yields the theoretical amount of sulphuric acid, whilst the meta-acid does not yield any.

For the estimation of pure parasulphanilic acid, 17·3 grams of the sample is dissolved in water, and made up to a litre; 100 c.c. of this solution is, if at all alkaline, slightly acidified with hydrochloric acid and mixed with saturated bromine water until a drop of the liquid gives a blue spot on potassium iodide-starch paper. After 20 minutes, the liquid is rendered faintly alkaline with aqueous soda, gently warmed for a short time, and the sulphuric acid estimated in the filtrate, as usual, by precipitating with barium chloride. If free sulphuric acid is present, it must be estimated by precipitating a known quantity of the original compound with barium chloride, and deducting the amount from the total acid.

The estimation of parasulphanilic acid in presence of metasulphanilic acid is effected in the same way as with the pure substance; the precipitation with barium chloride must, however, be effected at a boiling heat, and the precipitate washed with boiling water without delay. L. DE K.

Acidity of Urine. By E. LÉPINOIS (*J. Pharm.*, 1896, [6], **3**, 8—16).—The methods proposed for the estimation of the acidity of urine are enumerated and discussed; the presence of sodium dihydrogen phosphate, disodium hydrogen phosphate, sodium sulphate, and sodium chloride, alone or together, have no effect if potash is used for the titration, but they slightly influence the results if baryta water is employed. It is preferable to add alkali in excess and then titrate with acid, rather than to titrate with alkali directly, as in the former case the end point is observed more easily. It has been previously shown that if the urine is heated, the acidity is greater than at the ordinary temperature, this is probably caused by the alkali liberating ammonia; phosphates have an opposite effect; the observed difference in the titration values is the resultant of these effects. The most trustworthy results were obtained as follows: The urine (25 c.c.) is diluted with water (1—2 parts), according to its colour, phenolphthaleïn added, and then potash (10—15 c.c., N/4), the excess of the latter being titrated with hydrochloric acid (N/4). The observation of the end of the reaction is facilitated by treating a second and equal quantity of urine with water and alkali only, and comparing the colours.

J. B. T.

Volatile Acids of Wines. By HENRY JAY (*Bull. Soc. Chim.*, 1896, [3], **13**, 642—644).—The sample is distilled in a current of steam for 1—1¼ hours, and the distillate titrated with alkali. The amounts found in various genuine French and Spanish wines varied between limits corresponding with 0·38 to 0·8 gram of monhydrated sulphuric acid per litre. Algerian wines usually contain more than this, and are thus easily recognised. JN. W.

Simultaneous Estimation of Organic and Inorganic Acidity in Beetroot Juice. By D. SIDERSKY (*Compt. rend.*, 1895, **121**, 1164—1165).—Paper treated with a 0·1 per cent. aqueous solution of Congo red 4R gives a deep blue stain with a drop of a dilute inorganic acid, but is not affected by organic acids. If therefore beetroot juice is titrated with an alkali until a drop of the solution no longer gives a blue stain on the Congo red paper, the proportion of sulphuric acid is determined, and if the addition of alkali is then continued until the liquid ceases to be acid to litmus, the organic acids can be estimated.

Beetroot juice becomes dark brown when exposed to air, but this change is prevented by the presence of sulphuric acid. If, therefore, standard alkali is added to the liquid, with constant agitation, until the brown colour ceases to disappear, the sulphuric acid can be determined. Further addition of alkali with litmus paper as an indicator will give the quantity of organic acids. C. H. B.

Analysis of Fats: Colour Reactions. By JULIUS LEWKOWITSCH (*J. Soc. Chem. Ind.*, 1894, **13**, 617—621).—The author has proved by a long series of experiments that the colour tests with sulphuric and phosphoric acids, phosphomolybdic acid, and chlorine gas are quite untrustworthy. The colours produced by these reagents are not due so much to the fat or oil as to some impurities generally occurring in them. As soon as these are removed by an improved manufacture, the tests no longer show the adulteration. L. DE K.

The Correct Iodine Number. By HUGO SCHWEITZER and EMIL E. LUNGWITZ (*J. Soc. Chem. Ind.*, 1895, **14**, 130—133).—The authors have proved by a large number of experiments that when working with the Hübl solution the action is not merely an additive one, but that substitution, with formation of hydrogen iodide, also takes place. The true iodine number is therefore obtained by subtracting from the total iodine absorbed, the iodine corresponding with the liberated hydrogen iodide.

This is estimated, after the usual titration with potassium iodide and sodium thiosulphate, by adding some potassium iodate and again titrating the liberated iodine, the amount of which depends on the quantity of free acid in the mixture. A large proportion of the acid may, however, be due to the Hübl solution, and the usual blank experiment should therefore be made. L. DE K.

Determination of the Oxidisability of Oils. By W. BISHOP (*J. Pharm.*, 1896, [6], **3**, 55—61).—The oxidation of oil is greatly facilitated by the addition of a little manganese resinate, which is obtained from the commercial product by extraction with light petroleum or ether. The oil (5—10 grams) is mixed with the resinate (2 per cent.) until the latter is completely dissolved, the solution (1·2 gram) is intimately mixed with calcined anhydrous precipitated silica (1 gram), and exposed to the air at 17—28°; in the case of non-drying oils, such as colza and olive oil, the best temperature is 20—30°. The assay is weighed at the end of 2, 6, and 16 hours, a fresh surface being exposed after each weighing. An oil of normal density but of poor quality is readily detected, and the values obtained serve to control, or even replace, the "iodine number," moreover, valuable information is obtained as regards the nature of the oil, its maximum degree of oxidation, and the time required to attain this.

The following numbers give the average maximum percentage increase of weight shown by the respective oils when treated as above; the density of each is given in brackets. Linseed oil (French) = 17·05 (0·9327); linseed oil (La Plata) = 15 20 (0·9304);

hemp seed oil = 14·40 (0·9287); poppy seed oil (French) = 14·20 (0·924); nut oil (commercial) = 13·70 (0·924); cotton seed oil (demargarified) = 9·45 (0·923); cotton seed oil = 8·60 (0·924); sesame oil (Senegal) = 8·70 (0·9215); sesame oil (Indian) = 7·40 (0·921); palm oil (African) = 6·70 (0·916); palm oil (white) = 6·50 (0·916); colza oil (French) = 6·40 ? (0·9142); colza oil (Indian) = 5·85 ? (0·9137); olive oil = 5·30 ? (0·9155). The oxidation of colza oil and olive oil proceeds so slowly that it is doubtful whether the above values are the maxima. J. B. T.

Detection of Vegetable or Animal Oil in Mineral Oil. By Georges Halphen (*J. Pharm.*, 1896, [6], **3**, 16—19).—Royère's test for animal and vegetable oil in mineral oil is based on the fact that the former contains acids, and therefore give a rose coloration when mixed with aqueous magenta solution which has been decolorised by means of soda. It is pointed out that mineral oil (petroleum) contains acids, even when prepared with the greatest care and in a high state of purity. A considerable number of lubricants are known, of variable consistency, composed of mineral oil intimately mixed with an alkali, or alkaline-earth-soap; in these cases also the test does not apply as the acids are neutralised. The presence of alkali in such substances is readily detected by agitation with a solution of Congo red which has been rendered violet by the minimum amount of hydrochloric acid. J. B. T.

Commercial Analysis of Lard. By Hugo Schweitzer and Emil E. Lungwitz (*J. Soc. Chem. Ind.*, 1894, **13**, 614—616).—The authors state that it is easy to prepare a compound which will pass as pure lard, when judged by its specific gravity, melting point, saponification equivalent, refractive index, and volatile fatty acids.

Cotton seed oil and similar vegetable oils may be detected by Milliau's phosphomolybdic acid test or by his modified Bechi's silver test. Should these tests point to adulteration, the rise of temperature with sulphuric acid and the iodine absorption should be taken. The crystallisation point is also a good test for the purity of lard; to detect addition of tallow, the sample should be recrystallised from ether, and the deposit microscopically examined.

L. de K.

Analysis of Lard Oil. By Hugo Schweitzer and Emil E. Lungwitz (*J. Soc. Chem. Ind.*, 1895, **14**, 129).—Any sample with a higher iodine number than 70 should not show any sign of cloudiness above 40° F.; oils with an iodine number of 60—64 are generally pasty at that temperature.

The congealing point is taken by putting the oil in a 4 oz. wide-mouth bottle surrounded by a mixture of ice and salt and stirring vigorously with a thermometer; when the oil shows the first sign of becoming cloudy, the temperature is recorded. L. de K.

Analysis of Whale Oil. By Hugo Schweitzer and Emil E. Lungwitz (*J. Soc. Chem. Ind.*, 1895, **14**, 130).—The authors having examined a large number of samples of pure whale oil, state that the refined oil should have the following qualities. It must be clear and of a pale yellow colour; its specific gravity must be between 0·921 and 0·923 at 15·5°; the iodine number must be between 120 and 130.

The melting point of the fatty acids must not be higher than 20°, and the saponification value should be between 190 and 200. The Milliau test should leave the fatty acids unaffected. L. DE K.

Santal Wood Oil. By ERNEST J. PARRY (*Pharm. J. Trans.*, 1895, **55**, 118—119).—Santal wood oil is digested with an equal volume of acetic acid in a pressure flask for an hour and a half at 150°, washed until free from acid, dried, and the oil then saponified with alcoholic potash, the amount of the latter used being noted; this in the case of the genuine oil is found to be equal to about 19 per cent. on the weight taken. Cedar wood oil, a common adulterant of the former, when similarly treated, only requires about 2 per cent. of potash. The author thinks the difference can be depended on to detect adulterations of 10 per cent. and upwards. R. R.

Analysis of Soap. By ED. SPAETH (*Zeit. angw. Chem.*, 1896, 5—9).—In order to avoid the use of a weighed filter and the troublesome removal of the insoluble matter from the sides of the beaker, the author now recommends drying and afterwards extracting with alcohol in the apparatus previously described by him for the testing of butter (Abstr., 1894, ii, 124).

The moisture may also be estimated by drying the sample after mixing with sand, or by dissolving in proof spirit and evaporating an aliquot part of the solution. In presence of glycerol or other more or less volatile matter, the water cannot be estimated by a direct experiment. The total alkali is estimated by decomposing the alcoholic solution of the soap by a known amount of normal acid and agitating the liquid in a separating funnel with light petroleum; the alcoholic liquid is then drawn off, and the petroleum washed twice with a little proof spirit which must be added to the main liquid; the excess of acid is then titrated with normal alkali. An aliquot part of the light petroleum containing the fatty matter is distilled in a small, weighed flask, and the residue finally dried in a current of dry hydrogen. L. DE K.

New Reaction for the Detection of Soap in Lubricants. By HUGO SCHWEITZER and EMIL E. LUNGWITZ (*J. Soc. Chem. Ind.*, 1894, **13**, 1178).—Five drops of the oil or melted fat is dissolved in 5 c.c. of benzene (boiling point below 75°) and 1 c.c. of a saturated solution of metaphosphoric acid in absolute alcohol is added. If the fats are free from soap, the mixture remains clear for even 24 hours, but in the presence of soap, or of so-called "gelatin" (which is mineral oil containing 10 per cent. of alumina soap) an immediate precipitate of a metallic phosphate is obtained. When testing waxes or ozokerite, the substance and the reagent should both be dissolved in ether.

If, on adding to the alcoholic ethereal solution containing the phosphatic precipitate, a drop of alcoholic platinum chloride, the precipitate dissolves, a sodium, calcium, or magnesium soap is most likely present; a crystalline appearance in the precipitate indicates potassium, whilst if the precipitate remains unchanged, the presence of iron or aluminium soaps may be suspected. L. DE K.

Detection of Aloes in Mixtures. By ALOIS KREMEL (*J. Pharm.*, 1895, [6], **2**, 503—505).—To remove foreign matters which would interfere with the tests for aloes, the tincture, or the alcoholic extract of solid material, or, in the case of an aqueous solution, the alcoholic extract of the residue left on drying, is concentrated on a water bath, extracted with hot water so as to make a 1 per cent. solution of aloes, treated with excess of basic lead acetate, filtered, and the excess of lead removed by sodium sulphate; after filtration, the solution is ready for tests for aloes with bromine, copper sulphate, ammonia, or nitric acid. D. A. L.

Identification of Alkaloïds and Glucosides. By EMANUEL FORMÁNEK (*Chem. Centr.*, 1895, i, 1148; from *Pharm. Post*, **18**, 179). —Aloïn dissolves in nitric acid with a red coloration, changing to yellow; the residue after evaporation gives a red solution with alcohol, which changes to brown with gaseous ammonia, to yellow with soda, and to violet and rose successively, with alcoholic potassium cyanide. Amygdalin gives a yellow residue on evaporation with nitric acid; this changes to rose-red with gaseous ammonia, brownish-red with aqueous ammonia, and rose-violet with alcoholic potash. Brucine, after treatment with nitric acid, gives a yellow residue which becomes grass-green with aqueous ammonia, and violet with hydrogen sulphide solution. Cotoïn gives a dull green coloration with nitric acid, the residue after evaporation being brownish-red; with gaseous or aqueous ammonia, it changes to dull green, and then to brown. Emodin yields a brownish-red residue with nitric acid, changing with aqueous ammonia to violet, then to dull red; with alkali, the colour is violet, changing to brown. Narcotine gives a yellowish-green residue with nitric acid, changing with gaseous ammonia to dull green, then to brown; the same colour is produced by alkali, but on heating it becomes brick-red. Physostigmin gives a cinnabar-coloured residue with nitric acid which becomes green when heated or dissolved in water; with alkali or ammonia, the green slowly changes to brown. With nitric acid, salicin gives a light yellow residue, which becomes blood-red when heated with potassium cyanide. Strychnine gives a yellow residue with nitric acid, changing to orange-yellow with ammonia; dilute alcoholic alkali colours this residue reddish-violet, then it slowly turns brown; the presence of brucine in considerable proportion has no effect on these reactions.

J. B. T.

Estimation of Nicotine and Ammonia in Tobacco. By RICHARD KISSLING (*Zeit. anal. Chem.*, 1895, **34**, 731—734).—The author is unable to acquiesce in either the objections to his process, or the modifications therein proposed by Vedrödi (see Abstr., 1882, 1005; 1893, ii, 504; 1894, ii, 75; 1895, ii, 541). Light petroleum is a less suitable solvent for the nicotine than ethylic ether, since it is never entirely free from high-boiling constituents, and these must interfere with any attempt to distil off the petroleum without loss of nicotine (which, however, Vedrödi does not propose to do). If the process is carried out according to the original instructions, there is no danger of soda being carried over with the nicotine. On the other hand, Vedrödi's test analyses were carried out with an entire disregard of his own caution (Abstr., 1893, ii, 504) that the amido-compounds in tobacco are decomposed with evolution of ammonia when heated with soda. The estimation of ammonia in tobacco is a far less simple matter than is assumed by Vedrödi. The following is the process given in the author's "Tabakkunde." The nicotine is first estimated. Then 10 grams of tobacco is extracted with 100 c.c. of 40 per cent. alcohol in a flask with reflux condenser, the extract filtered when cold, and an aliquot part of it freed from alcohol; the residue is then mixed with dilute sulphuric acid, and the albumin, peptones, nicotine, and ammonia are precipitated by the smallest possible excess of phosphomolybdic acid. An aliquot part of the filtrate from this precipitate is evaporated with some barium chloride, and the nitrogen it contains determined. A third portion (20 grams) of the tobacco is digested with about 350 grams of water acidified with sulphuric acid, the total solution (including the moisture of the original tobacco) made up to 400 grams, and 200 grams of the filtrate is freed from proteïds by the addition of mercuric chloride. An aliquot part of the filtrate is freed from mercury by hydrogen sulphide, and the amides are converted into amido-acids and ammonia by boiling the acid filtrate for an hour. After the addition of an alkali, the ammonia and nicotine are distilled over into titrated sulphuric acid. These results give the data for calculating the ammonia, amides, and nicotine, and the remaining nitrogen in the tobacco is assigned to albumin.

Finally, attention is called to errors of calculation in Vedrödi's paper. M. J. S.

Estimation of small Amounts of Aniline in Toluidine, and of Toluidine in Aniline. By PAUL DOBRINER and WILHELM SCHRANZ (*Zeit. anal. Chem.*, 1895, **34**, 734—740).—Reinhardt has shown (*Chem. Zeit.*, **17**, 413) that the proportions of aniline and toluidine in a mixture of the two can be calculated from the amount of bromine absorbed when a hydrobromic acid solution of the bases is treated with a mixture of potassium bromide and bromate, obtained by dissolving bromine in potash, and boiling the solution until free from hypobromite, inasmuch as, by the action of nascent bromine, aniline is converted into a tribromo-derivative, whilst the toluidines yield only dibromo-derivatives. The formula $x = 2{\cdot}37\,vt - 1{\cdot}37\,a$, in which a is the weight of the mixture, v the volume of bromine solution, t its titre referred to pure aniline, gives x the amount of aniline present. Since the strength of the bromine solution is ascertained by experiments on pure aniline, the above formula is calculated on the supposition that 160·5 parts of toluidine will absorb exactly as much bromine as 93 parts of aniline, and for mixtures in which the aniline predominates, this assumption is sufficiently near the truth, very small proportions (1 per cent.) of toluidine, added to pure aniline, being shown with considerable accuracy. But when the same formula is applied to mixtures in which toluidine is the chief constituent, the numbers for aniline come out somewhat too high, in consequence, it would seem, of the formation of small quantities of monobromotoluidine. In such cases, the error may be entirely obviated by standardising the bromine solution with pure toluidine, and calculating the titre for aniline by multiplication with $\frac{93}{160\cdot5}$, or if t and T, the titres for aniline and toluidine respectively, be both ascertained experimentally, the equation becomes $V = \frac{x}{t} + \frac{a - x}{T}$ $\left(\text{erroneously given in the original as } \frac{x - a}{T}\right)$. The end of the bromination is ascertained by iodised starch paper. With paratoluidine, the bromine solution must be added slowly. M. J. S.

Estimation of Water in Aniline and in Ortho- and Paratoluidine. By Paul Dobriner and Wilhelm Schranz (*Zeit. anal. Chem.*, **34**, 740—742).—By means of Reinhardt's process (see preceding abstract), the amount of water in aniline, or orthotoluidine, or any mixture of the two, may be very easily estimated. It suffices to ascertain the bromine absorption, a, of the sample in its original condition, and b, after drying with ignited potassium carbonate. The percentage of water is then equal to $100(b - a)/b$. Two treatments with potassium carbonate should be given, since a single treatment does not entirely remove the water.

This method does not succeed with paratoluidine, but, since commercial paratoluidine contains but little aniline, it suffices to distil off about 10 per cent., when the remainder may be regarded as dry. Other substances which exhibit a constant bromine absorption may be similarly examined, and the authors are endeavouring to apply the method to substances which do not absorb bromine, by adding a known amount of dry aniline and then proceeding as above.

M. J. S.

Estimation of Morphine in Opium. By Lyman F. Kebler (*J. Soc. Chem. Ind.*, 1895, **14**, 464—466).—The morphine obtained in an opium assay is never quite pure, but leaves a small percentage of ash; merely deducting this ash, however, does not give the true amount of the alkaloïd. The ash should be analysed, and its calcium carbonate calculated into calcium meconate, which, with the weight of the remainder of the ash, is deducted from the weight of the morphine precipitate. L. de K.

Estimation of Tanning Matter. By Henry R. Procter (*J. Soc. Chem Ind.*, 1894, **13**, 494—495).—The gravimetric process, consisting in determining the total solids of a bark infusion before and after treatment with hide powder, the difference being taken as tannin, is still considered the best. The hide powder must, however, be thoroughly washed to remove any soluble matter, and then well squeezed. In accurate analysis, it is necessary to allow for the number of cubic centimetres of water introduced into the mixture by the moisture of the hide powder, and this may be done with sufficient accuracy by strongly pressing a known weight of the damp powder in folds of cloth and noticing the diminution in weight.

If the mixture be agitated violently by means of machinery for 10 minutes with three successive portions of hide powder, the tannin will be found to have been completely removed. L. DE K.

A Colorimeter: Colorimetric Estimation of Hæmoglobin. By WILHELM ZANGEMEISTER (*Zeit. Biol.*, 1896, **33**, 72—84).—The principle of the apparatus is the following: It consists of two glass tubes, and opening, at right angles, into the end of each is a funnel. Within the glass tubes, slide glass tubes having the inner ends closed; these tubes can be pushed to and fro; if the glass is pulled out, the liquid in the funnel runs into the tube, and in this way liquid is drawn into the tube until the tint, seen lengthwise, equals that in the other tube, which is a standard. The apparatus is described with full details, and is stated to give better results than the instruments of Gowers, Fleischl, &c. The results were controlled by estimations of iron in the ash. The same instrument may be used for the colorimetric estimation of other substances. W. D. H.

General and Physical Chemistry.

Wave-length of the D_3 Helium Line. By A. DE FOREST PALMER, jun. (*Amer. J. Sci.*, 1895, [3], **50**, 357—358).—Owing to the recent increased interest in the wave-length of the helium lines the author has been led to calculate some observations which he has carried out on the D_3 chromosphere line. The measurements were made on a large, fixed telescope spectrometer, with a plane speculum metal grating, having about 14,000 lines to the inch, and 5 inches of grating space. The average of 17 values found gives 5878·939 ± 0·006 for the wave-length of the D_3 line. H. C.

Three different Spectra of Argon. By JOSEF M. EDER and E. VALENTA (*Monatsh.*, 1896, **17**, 50—56).—The authors give a table of the wave-lengths from $\lambda = 2050$ to $\lambda = 2439$ of the lines in the blue argon spectrum. They find, also, that in addition to the blue and red spectra, there is a third spectrum of argon which is obtained by the application of very large condensers with a large Ruhmkorff and powerful currents in the primary coil. Under a pressure of 15 to 20 mm., a brilliant white light then appears in the capillary. Under pressures of 2 to 10 mm. the third spectrum is distinguished by the fact that many of the lines peculiar to the blue argon spectrum appear more distinct, and others weaker, and that entirely fresh lines become visible. The red argon spectrum disappears completely in low pressure tubes, but appears again partially when the pressure is increased. At 20 mm. pressure, many of the lines completely coincide with those of the red and blue spectra, but whole groups of lines show a displacement towards the red end of the spectrum, although the connection between these and corresponding lines of the blue spectrum is apparent.

The authors are unable to confirm Crooke's statement that the red argon spectrum is produced by the positive, and the blue spectrum by the negative pole. H. C.

Electrolytic Dissociation and Light Absorption. By FREDERICK G. DONNAN (*Zeit. physikal. Chem.*, 1896, **19**, 465—488).—The author has investigated the light absorption of solutions of violuric acid by aid of a colorimeter, of which diagrams and a description are given. The dissociation in N/32, N/64, N/128, and N/256 solutions are calculated from the absorption, and the results are found to agree well with those obtained from the conductivity. The addition of hydrogen chloride causes a decrease in the dissociation, and the concordance of the colorimetric and conductivity results is again satisfactory. Parahydroxybenzoic acid was also employed instead of hydrogen chloride owing to the approximate equality of its dissociation constant to that of violuric acid, and in this case, as also for the addition of levulinic and acetic acids, satisfactory results for the decrease in dissociation were obtained colorimetrically. The addition of sodium chloride gives rise to an indeterminate equation for the concentration of the colouring ions; but, on the assumption that the undissociated sodium violurate possesses an absorptive power equal to that of the acid ion, an approximate result is obtained which is, however, not in good agreement with the colorimetric observations. The assumption is afterwards shown to be not quite correct, as the absorptive power of the salt is slightly greater than that of the acid ion. (See also Abstr., 1893, ii, 510; 1894, ii, 8, 226; 1895, ii, 433.) L. M. J.

Phosphorescent Radiations. By HENRI BECQUEREL (*Compt. rend.*, 1896, **122**, 420—421).—When potassium uranium sulphate is placed on a sheet of paper, which is laid on a gelatino-bromide plate previously wrapped in two sheets of thick, black paper, and exposed to sunlight for several hours, a black silhouette of the phosphorescent substance is obtained on the plate on development. When pieces of money or metal screens are interposed between the phosphorescent substance and the photographic plate, an image of these objects is obtained on development. The same results are obtained when a thin sheet of glass is placed between the uranium salt and the paper, and hence they cannot be attributed to the action of vapours given off by the phosphorescent substance. C. H. B.

Absorption of Röntgen Rays by Chemical Compounds. By V. NOVÁK and OTTOKAR ŠULC (*Zeit. physikal. Chem.*, 1896, **19**, 489—492). —The authors have determined qualitatively the transparency to the Röntgen rays of various chemical compounds. Compounds containing only carbon, hydrogen, oxygen, and nitrogen are, as a rule, transparent, but opacity is induced by the presence of a halogen, the action of bromine and iodine being more marked than that of chlorine. The elements of low atomic weight fall into the following series. Sulphur = phosphorus, aluminium, magnesium, boron = carbon, the transparency increasing with decreasing atomic weight. Salts of like nature gave the following orders: rubidium, potassium, sodium, lithium, ammonium; barium, strontium, calcium, magnesium, beryllium; while, further, calcium and strontium possess absorptive powers approximately equal to those of potassium and rubidium. The acid radicles fall into the following series of increasing transparency: carbonate, nitrate, sulphate, chloride, bromide, iodide, chlorate, bromate, iodate, phosphate, arsenate. From this it appears that the absorptive power is a direct function of the atomic weight, or, in the case of radicles, of the mean atomic weight; while also for electrolytes the absorptive power is an additive function of the absorptive powers of the ions. L. M. J.

Colour Photography. Substitution of Organic Colouring Matters for the reduced Silver of Photographic Proofs. By GEORGES A. RICHARD (*Compt. rend.*, 1896, **122**, 609—611).—Three negatives are taken, after the method of Ducos du Hauron, corresponding respectively with the red, blue, and yellow radiations of reflections of the subject; prints of each are then taken on sensitive plates or films, the result being three transparent positives giving in black the relative intensities of the red, the yellow, and the blue of the original subject. The reduced silver forming these images is next converted into some compound capable of fixing or precipitating a red organic colouring matter for the first, a yellow for the second, and a blue for the third. The superposition of the three images gives a transparent, coloured reproduction of the subject. No information is given respecting the modes of treatment or the colouring matters best adapted to the purpose. J. F. T.

Parasite Electrodes. By G. DELVALEZ (*Compt. rend.*, 1895, **121**, 492—494).—When a strip of brass is placed between two copper electrodes in a rectangular vessel containing a solution of the mixed acetates of copper and lead, metallic deposits form on the side nearest to the positive electrode, and on the opposite side peroxide of lead is thrown down. The colours which these deposits present vary with the different conditions of electrolysis, and are described by the author. H. C.

Temperature of the Sparks produced by Uranium. By GABRIEL CHESNEAU (*Compt. rend.*, 1896, **122**, 471—473).—The sparks detached from uranium by friction with hard steel, &c., instantly ignite mixtures of methane and air, and it follows, from the results of Mallard and Le Chatelier, that their temperature cannot be below 1000°. They also ignite alcohol, benzene, or light petroleum which has been poured on cotton. Sparks detached from steel by means of flint ignite none of these gases and vapours. C. H. B.

Optical Method of Determining the Critical Temperature. By MICHAEL ALTSCHUL (*Chem. Zeit.*, 1895, **19**, 1917—1918).—In the optical method of determining the critical temperature, the point at which the meniscus of the liquid disappears and that at which it reappears are observed. It has been asserted by some observers that these two points do not coincide, and as, if this were the case, uncertainty would be introduced into determinations of the critical temperature by this method, the author has submitted this point to direct examination by experiment. He finds that there is no difference between the temperature at which the meniscus disappears and that at which it reappears. Where differences have been assigned, this was probably due to the liquid not having fully acquired the temperature of its surroundings. Even in the case of mixtures of liquids, the two temperatures are absolutely coincident. H. C.

Some Physical Aspects of Argon. The Ideal Thermometrical Substance for High Temperatures. By W. R. QUINAN (*J. Amer. Chem. Soc.*, 1895, **17**, 477—483).—Argon has dispelled certain beliefs in regard to monatomic gases. High boiling points can no longer be regarded as characteristic. Diatomic gases, such as hydrogen and nitrogen, have a fatal theoretical defect when used as thermometrical substances at very high temperatures; being diatomic, a certain part of their energy takes the form of internal energy; a part of the heat being thus latent, and being without effect on the temperature, equal quantities of heat cease to correspond with equal degrees of temperature. Argon has no internal energy; the decomposing influence of heat is absent; being monatomic, it cannot suffer dissociation, and its behaviour as a thermometric substance throughout the range of temperature will be strictly normal. Therefore at high temperatures argon is the ideal thermometric substance.

H. C.

Vapour Tensions of Mixtures of Volatile Liquids. By Charles E. Linebarger (*J. Amer. Chem. Soc.*, 1895, **17**, 615—652, and 690—718).—Up to the present, investigations of the vapour tensions of mixtures of liquids have been mainly confined to cases in which the dissolved substance is supposed to be non-volatile, and the solutions are made dilute. In the few cases in which mixtures of two volatile liquids have been considered, it has been usual to work with such as are now known to be composed of associated molecules, and to make no attempt to determine the partial pressure exerted by each vapour. The author has therefore determined the vapour tensions of mixtures in all proportions of certain "normal" liquids which are freely soluble in one another, and has further determined the partial pressures of the mixture's components, and also their concentrations in the gaseous phase.

The method used was founded on the determination of the quantity of a volatile liquid carried off by a definite volume of an inert gas made to pass through it, and the direct subsequent analysis of the gaseous mixture, either by passing it through appropriate liquid absorbents, or over decomposing agents. A full description of the apparatus used is given in the paper. The method can be said to give the vapour tensions of pure liquids with an accuracy equal to that obtainable by the best of other methods only when the liquids are not very volatile, but the results obtained by it for mixtures of liquids of not too different volatilities are accurate enough to serve as the experimental basis for theoretical deductions and generalisations.

The tension of the mixed vapour emitted by the mixtures of the volatile liquids examined was always greater than the tension of the less volatile liquid, and always less than that of the more volatile liquid; also the partial pressure of either component of any mixture was always less than the vapour tension of the component in a state of purity. The mixtures examined may be divided into four classes. The first class, represented by mixtures of benzene and toluene with monochloro- and monobromo-benzene, present the very simplest phenomena, the vapour tensions of these mixtures being linear functions of the concentration. The second class is represented by mixtures of chloroform with benzene and with toluene, and here the vapour tension is less than that resulting from the calculation by the rule of mixtures, the variation reaching a maximum when 100 molecules of the mixture contain from 50 to 60 molecules of chloroform. In the third class, of which mixtures of carbon tetrachloride with toluene and with benzene are representative, a very different behaviour was noticed. When benzene or toluene is added to carbon tetrachloride, the curve of total tensions follows closely the line connecting the points corresponding with the vapour tensions of the mixed liquids, until towards the abscissæ value of 80; the curve then commences to fall, only to rise again, and pass above the straight line, when finally it changes its direction to fall upon the axis of ordinates at the point corresponding with the vapour tension of the pure hydrocarbon. The curve has, therefore, three turning points. The fourth class of mixtures, of which the only representative here was a mixture of nitrobenzene and carbon tetrachloride, is really that of a volatile liquid with an almost non-volatile one. As would naturally be expected, the partial pressure of the carbon tetrachloride and the total pressure of the mixture are almost identical.

It was found by direct experiment that the laws deduced from observations made at any one temperature are applicable to any other temperature, at any rate when the latter is not very far removed from that of the observations. The relations between the concentrations in the gaseous and liquid phases were found to be quite simple, and entirely in accordance with the provisions of the theoretical relations established by Planck and Nernst.

The vapour tensions of mixtures of acetic acid with benzene and with toluene were determined, and from the results the author calculates the molecular mass of the dissolved and liquid acid, the numbers agreeing with those obtained by Ramsay and Shields. A general method for the determination of the molecular masses of associated liquids at any given temperature is indicated in these results.

H. C.

Thermochemistry of Chlorobenzoic acid and some of its Derivatives. By PAUL RIVALS (*Compt. rend.*, 1896, **122**, 480—482). —*Orthochlorobenzoic acid:* Heat of combustion per gram +4688 Cal. per molecule +773·7 Cal.; heat of formation +103·0 Cal.; heat of neutralisation +15·5 Cal., which is 1·5 Cal. higher than that of benzoic acid.

Potassium chlorobenzoate, $2C_7H_4Cl{\cdot}O_2K + H_2O$: Heat of dissolution +0·72 Cal.

$C_7H_4ClO_2K$ diss. + HCl diss. = $C_7H_5ClO_2$
pptd. + KCl diss. .... develops +4·4 Cal.
$C_7H_5ClO_2$ sol. + Aq = $C_7H_5ClO_2$ diss..... absorbs −6·2 „
$C_7H_5ClO_2$ sol. + KOH sol. = ($C_7H_4ClO_2K$
+ $\frac{1}{2}H_2O$) sol. + $\frac{1}{2}H_2O$.............. develops +21·2 „

Chlorobenzoic chloride: Heat of combustion per molecule +743 Cal.; heat of formation (liquid) +64 Cal., and hence

$C_7H_4ClO_2$ liq. + H_2O liq. = $C_7H_5ClO_2$ sol.
+ HCl gas .... develops −7·2 Cal.

Whereas in aldehyde practically the same amount of heat is developed by the substitution of chlorine for either the functional hydrogen or the hydrogen of the methyl group; in benzaldehyde, on the other hand, the substitution of chlorine in the nucleus is comparable with its substitution in the methyl radicle, but the contiguity of the nucleus modifies the character of the aldehyde group, and the substitution of chlorine for the functional hydrogen results in a development of heat of a very different order of magnitude.

C. H. B.

Thermochemistry of the Amides and Ammonium Salts of some Chloro-acids. By Paul Rivals (*Compt. rend.*, 1896, **122**, 617—619).

Heats of neutralisation:—

$CH_2Cl\cdot COOH$ diss. + NH_3 diss.	+12·7 Cal.
$CCl_3\cdot COOH$ diss. + NH_3 diss.	+13·1 „
$C_6H_5\cdot COOH$ diss. + NH_3 diss.	+12·1 „
$C_6H_4Cl\cdot COOH$ (ortho) diss. + NH_3 diss.	+13·1 „

Heat of Formation of Chloro-amides.—The combustion is accelerated by adding a known weight of camphor. The following are the figures.

1 gram $CH_2Cl\cdot CO\cdot NH_2$ develops on burning	+2599 Cal.
1 „ $CCl_3\cdot CO\cdot NH_2$ „ „	+1020 „
1 „ $C_6H_4Cl\cdot CO\cdot NH_2$ „ „	+5200 „

From these figures, the heats of combustion and of formation are deduced.

	Heat of combustion.		Heat of formation.
	at const. vol.	at const. press.	Cal.
$CH_2Cl\cdot CO\cdot NH_2$	+243·0 cal.	+242·9	+88·6
$CCl_3\cdot CO\cdot NH_2$	+165·9 „	+165·2	+107·1
$C_6H_4Cl\cdot CO\cdot NH_2$	+808·9 „	+808·2	+63·5

Determination of the heat developed in the formation of chloro-amides from ammonia and the chloro-acid gave the following figures.

$CH_2Cl\cdot COOH$ sol. + NH_3 gas = $CH_2Cl\cdot CO\cdot NH_2$ sol. + H_2O liq.	19·5 Cal.
$CCl_3\cdot COOH$ sol. + NH_3 gas = $CCl_3\cdot CO\cdot NH_2$ sol. + H_2O liq.	19·2 „
$C_6H_4Cl\cdot COOH$ sol. + NH_3 gas = $C_6H_4Cl\cdot CO\cdot NH_2$ sol. + H_2O liq.	17·2 „

J. F. T.

Heats of Solution of some Carbon Compounds. By Clarence L. Speyers (*J. Amer. Chem. Soc.*, 1896, **18**, 146—156).—The heats of solution of some solid carbon compounds in water, methylic, ethylic, and propylic alcohols, chloroform, and toluene were determined by means of the simple method given by Nernst. The quantity of solvent compared with the quantity of substances dissolved was always so large that it is safe to conclude that further addition of solvent would produce no appreciable development of heat. The following table shows the heats of solution in a convenient form for comparison.

The solvents with which the numbers in each of the columns were obtained were: I, water; II, methylic alcohol; III, ethylic alcohol; IV, propylic alcohol; V, chloroform; VI, toluene. The numbers give the heats of solution in small calories.

	I.	II.	III.	IV.	V.	VI.
Urea	−3628	—	−3612	—	—	—
Urethane	−3787	−4345	−4728	−6045	−4573	−6399
Chloral hydrate	− 929	—	−1131	—	−5993	−7537
Succinimide	−4294	—	−5456	—	—	—
Acetamide	−1991	—	−3606	—	—	—
Mannitol	−5262	—	—	—	—	—
Resorcinol	−3960	—	+ 269·2	—	—	—
Benzamide	—	—	−4238	—	—	—
Paratoluidine	—	—	−3650	—	−3492	−4983
Acetanilide	—	−4477	−4212	—	−4442	—
Acenaphthene	—	−6180	−5986	−6807	−4480	−4788
Naphthalene	—	−4233	−4861	−5681	−3852	−4267
Phenanthrene	—	—	−4306	—	—	−3528
Cane sugar	−1318	—	—	—	—	—

H. C.

Molecular-volumetric Method of Determining the Molecular Weight. III. By Isidor Traube (*Ber.*, 1896, **29**, 1023—1029; compare Abstr., this vol., 235).—The author has calculated the co-volumes of a large number of substances by subtracting the sum of the atom-volumes of the constituent elements from the molecular volume obtained by dividing the molecular weight by the density, the proper allowance being made for the various types of rings, &c., present in the molecule. The atom-volumes employed are those which have been deduced from the study of the density of aqueous solutions of compounds of these elements, except in the cases of bromine and iodine, for which the values 17·7 and 21·4 respectively have been adopted. The molecular co-volume is thus found, for the great majority of substances, to be approximately constant, and equal to 25·9 c.c. at 15°. For substances which tend to form associated molecules, especially such as contain methyl and hydroxyl, the molecular co-volume is smaller than the average, and falls, as a rule, between 15 and 22. For tertiary substances, such as amines, compounds containing several halogen atoms, and ethers of high molecular weight, the molecular co-volume, on the other hand, is greater than the average, and generally falls between 30 and 32. In the cases of a few tertiary amines it is still higher. The density method can therefore be used for the determination of the molecular weight of liquids and solids, if sufficient information as to the valency of the nitrogen atoms, the mode of combination of the oxygen atoms, the types of ring present, &c., is available. If it is not, the molecular weight may be independently ascertained, and the density employed for the determination of the constitution.

A. H.

Cryoscopic Investigations. By A. Ponsot (*Compt. rend.*, 1896, **122**, 668—670).—The author has determined the limiting value of the molecular reductions of the freezing point of various solutions by the method already described (Abstr., 1894, ii, 342), and has obtained the following results.

Cane sugar	18·77	Potassium bromide	34·82
Acetic acid	18·5	Barium chloride	50·5
Oxalic acid	33·95	Calcium chloride	51·8
		Lead nitrate	47·0
Sodium chloride	34·28	Potassium sulphate	48·45
Potassium chloride	34·16	Sulphuric acid	47·20

Carbon compounds have not all a molecular reduction approximating to 18·5, and metallic salts of the same type have not exactly the same molecular value, contrary to the hypothesis of Arrhenius. If curves of molecular reduction are plotted, by taking the actual reductions as abscissæ and the molecular reductions as ordinates, the curves for potassium chloride, potassium bromide, and acetic acid have the same form as that for sodium chloride, and cut the axis of the ordinates almost perpendicularly, so that in very dilute solutions the reduction of the freezing point is practically proportional to the weight of salt in 100 grams of the solution. This result can be deduced from van't Hoff's equation if the variation in the concentration of the solution with the height of the liquid column is negligeable (Abstr., 1895, ii, 206). Consideration of the behaviour of sugar solutions, assuming that the sugar is distributed in the column of liquid as if it alone occupied the column, and was in the state of a perfect gas, shows that the experimental results agree closely with the mathematical expressions, and leads to the conclusion that when a sugar solution is placed in an osmotic tube, the lower part of which is immersed in pure water, the osmotic pressure is equal to gaseous pressure only at the level of the pure water.

The curves for oxalic acid, lead nitrate, and potassium sulphate indicate that the molecular reduction decreases as the concentration increases up to the formation of cryo-salts (Abstr., 1895, ii, 438). The curves for barium chloride, calcium chloride, and sulphuric acid show that in these cases the molecular reduction at first decreases very rapidly as the concentration increases, reaches a minimum, and then increases again. The solutions of both these groups of compounds have a heat of dilution which is not negligeable even in dilute solutions, and if van't Hoff's equation is applied to them, i must be regarded not as a constant, but as a quantity which varies with the concentration. C. H. B.

Determinations of the Molecular Weights of Some Inorganic Compounds. By HEINRICH BILTZ (*Zeit. physikal. Chem.*, 1896, **19**, 385—430).—This is a more complete account of the author's experiments (this vol., ii, 152); details of the method, and illustrations of the apparatus employed, being given. L. M. J.

Affinity Constants of some Organic acids. By JOHAN M. LOVÉN (*Zeit. physikal. Chem.*, 1896, **19**, 456—464).—The paper contains an extension of the author's determinations of the affinity constants of sulpho-derivatives of organic acids (Abstr., 1894, i, 325). The results obtained are given in the following table.

Acid.	*k*.
β-thiophencarboxylic acid	0·0078
Benzenesulphoneglycocine, $C_6H_5\cdot SO_2\cdot NH\cdot CH_2\cdot COOH$	0·0351
Orthotoluenesulphoneglycocine	0·0282
Paratoluenesulphoneglycocine	0·0347
1 : 3 : 4-xylenesulphoneglycocine	0·0270
Pseudocumenesulphoneglycocine	0·0248
1 : 3 : 4-xylenesulphonealanine, $C_8H_9\cdot SO_2\cdot NH\cdot C_2H_4\cdot COOH$	0·0243
Benzenesulphoneasparagine, $C_6H_5\cdot SO_2\cdot NH\cdot C_2H_3(COOH)_2$	0·0715
β-dibromomethanesulphonepropionic acid, $CHBr_2\cdot SO_2\cdot C_2H_4\cdot COOH$	0·0205
β-dichloromethanesulphonepropionic acid, $CHCl_2\cdot SO_2\cdot C_2H_4\cdot COOH$	0·0198
Benzenesulphinic acid (about)	3·5000
p-toluenesulphinic acid (about)	2·5000
Diphenyleneglycollic acid, $C_{12}H_8{:}C(OH)\cdot COOH$	0·1000
Selenodiacetic acid, $Se(CH_2\cdot COOH)_2$	0·0424

The last value is slightly smaller than that of the corresponding sulpho-compound (*loc. cit.*). L. M. J.

Chemical Equilibrium in Ammoniacal Solutions of Magnesium Salts. By Johan M. Lovén (*Zeit. anorg. Chem.*, 1896, **11**, 404—415).—The fact that magnesium hydroxide is not precipitated by ammonia in the presence of ammonium salts has been explained by assuming that double ammonium and magnesium salts were formed in the solution, or else by assuming the formation of complex salts in which the magnesium formed part of the negative ion. Neither of these assumptions is satisfactory, and it appears more probable that, in accordance with the dissociation theory, the part played by the ammonium salt is that of diminishing the amount of dissociated ammonium hydroxide in the solution. The number of hydroxyl ions present being thus reduced, the tendency for the formation of magnesium hydroxide is considerably lessened.

For the equilibrium of ammonia towards ammonium and hydroxyl, we have the equation

$$NH_4 \times OH = k \times NH_3,$$

where k is the dissociation constant of the ammonia. If C is the concentration of magnesium hydroxide in a saturated solution, and the magnesium hydroxide is fully dissociated, C is the concentration of the magnesium and $2C$ that of the hydroxyl ions. For the equilibrium of magnesium hydroxide toward the solution we have then

$$Mg \times (OH)_2 = 4C^3.$$

Combining this with the previous equation we get, finally,

$$C = \sqrt[3]{Mg \times \left(\frac{NH_3 \times k}{2 \times NH_4}\right)^2}.$$

The author has verified this relationship between the concentrations of the ammonia, the ammonium salts, and magnesium salts in solution. H. C.

The Velocity of Hydrolysis in Organic Solvents. By G. Gennari (*Zeit. physikal. Chem.*, 1896, **19**, 436—440).—The velocities of hydrolysis were determined for methylic and ethylic acetates, in methylic and ethylic alcohol solutions, sodium hydroxide and sodium ethoxide being employed. In ethylic alcohol, concordant results were obtained for the reaction constant, which was about 1/180 of the constant in aqueous solution, and smaller for the ethoxide than for the hydroxide. In methylic alcohol, however, the reaction does not proceed as rapidly, and soon ceases, notwithstanding the fact that the compounds are more strongly dissociated in this solvent. This result does not appear to be due to a reverse reaction, for experiments with sodium acetate and methylic alcohol gave no trace of alkali, so that dissociation does not appear to be the only factor affecting the velocity of hydrolysis. L. M. J.

Inversion of Sugar by Salts. By JOHN H. LONG (*J. Amer. Chem. Soc.*, 1896, **18**, 120—130).—The specific rotation of solutions of cane sugar is known to be decreased by the presence of many neutral salts, the diminution depending in varying degree on the molecular weights of the salts, the temperature, and the exposure to light. It was found, on examination of the syrup of ferrous iodide of the pharmacopeia, that an old solution was strongly lævorotatory, while a fresh solution gave a very marked right-handed rotation. Portions of the syrup were placed in stoppered bottles, exposed to light, and polarised at intervals of some weeks, a steady diminution in the rotation, and finally a complete inversion, being observed. Later experiments with two portions of the same solution, one in a bottle only partially filled, showed that the presence of air increases the rapidity of inversion in a marked degree. A temporary change in temperature does not produce a permanent change in the rotation. The influence of heat only becomes marked at a temperature above 60°, and at 100° an inversion can be accomplished in two hours, which would require a period of some months at the ordinary temperature. It was further found that the rate of inversion is more rapid in bottles exposed to the light than in similarly filled bottles kept in the dark. The rapidity of inversion is further increased if the solution is exposed to the action of light and heat together.

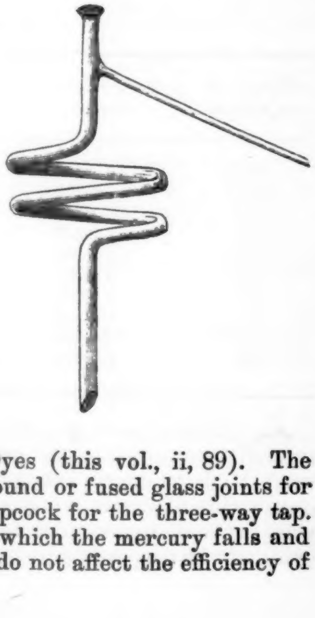
A number of other ferrous salts, and also salts of manganese, zinc, aluminium, lead, cadmium, and mercury were examined in their behaviour towards sugar, and found to act like ferrous iodide. The salts tested, although commonly called neutral, are those in which the base is very weak when compared with the acid. By direct experiment, it was shown that in the case of ferrous iodide the inversion proceeds according to the law of Wilhelmy. The cause of the inversion of strong sugar solutions by these salts is to be found in their condition of partial hydrolysis by the solvent. H. C.

Reciprocal Salt Pairs. By WILHELM MEYERHOFFER (*Monatsh.*, 1896, **17**, 13—28).—Pairs of salts which can be formed by double decomposition one from the other, such as KCl, NaBr, and KBr, NaCl, may be termed reciprocal salt pairs. At any given temperature one of the pairs will be stable and the other labile, so that the second pair will tend to become gradually converted into the first. Only at some one definite temperature would all four salts tend to coexist in an unchanged condition. This point is, in the case of solutions of the salts, a sextuple point in the sense of the phase rule, as six phases here co-exist, the four salts, the solution, and aqueous vapour. Six equilibrium curves must therefore meet in this point, each curve being that for the equilibrium between five phases. The author has not as yet succeeded in obtaining the sextuple point in any special case, but he gives in this paper the results of his investigations with the salt pair, $NaNO_3 + NH_4Cl$. H. C.

Water of Crystallisation. By THEODOR SALZER (*Zeit. physikal. Chem.*, 1896, **19**, 441—455).—The author adds the following rules regarding the water of crystallisation in hydrated salts to those previously enunciated (Abstr., 1895, ii, 488). (1) The crystalline salts of those benzene drivatives in which two negative groups are present in the ortho-position, contain less combined water than the corresponding para-derivatives. (2) The number of water molecules in neutral bivalent metallic salts of dibasic organic acids, increases with the separation of the carboxyl groups. (3) The water content of calcium salts of organic acids containing a methyl group is not altered by the replacement of the latter by another normal alkyl group. A large number of examples are adduced in the paper in support of these rules. L. M. J.

A New Bunsen Burner. By R. DIERBACH (*Ber.*, 1896, **29**, 865).—The burner described differs from the ordinary form in having an adjustable tube so attached to the foot that the flame can be placed in any required position. A. H.

A New Fractionating Column. By G. BERLEMONT (*Bull. Soc. Chim.*, 1895, [3], **13**, 674—675).—This column, suggested by Lebel, consists of a glass spiral, as shown in the figure; it combines a large cooling surface with economy in height. A column of this kind only 36 cm. high is equal in efficiency to one of the old pattern containing six bulbs. It, moreover, enables the thermometer to be read more easily. J. F. T.



Modification of von Babo's Water-mercury Pump for the Production of High Vacua. By J. PRECHT (*Ber.*, 1896, **29**, 1143—1145).—A modification of the von Babo pump described by Krafft and Dyes (this vol., ii, 89). The chief changes consist in substituting ground or fused glass joints for the rubber connections, and a simple stopcock for the three-way tap. The rubber joints on the tubes through which the mercury falls and rises are conveniently retained, as they do not affect the efficiency of the pump. A tube of phosphoric anhydride serves to absorb aqueous vapour. The glass joints are smeared with a mixture of wax and paraffin oil, as described by Hittorf, but lanolin may be used for the stopcocks. After working for two minutes, the pressure in the pump is unmeasurable by an ordinary manometer, a vessel of 1 litre capacity is exhausted to the same extent after 30 minutes, whilst after two hours the pressure in the pump = 0·00071 mm.; it is therefore well adapted for the preparation of tubes for the Röntgen rays. J. B. T.

Inorganic Chemistry.

Conditions which regulate the Combination of Gases. Union of Oxygen and Hydrogen at Low Temperatures. By (E. J.) Armand Gautier and H. Hélier (*Compt. rend.*, 1896, **122**, 566—573).—The mixture of the dried gases is allowed to circulate through a porcelain tube, filled with small pieces of broken porcelain, for a known time, the quantity of water formed being determined by absorption, and weighing.

The temperature of the interior of the tube is determined by means of a pyrometer capable of giving readings within 2°.

By these means, the authors have arrived at the conclusion that the union of oxygen with hydrogen begins at a temperature of 180°, and can be determined at 200°. Between 300—310°, the combination is about 3·8 per cent. The following table gives the quantity of water formed between these temperatures.

Temp. of experiment.	Weight of gas passed.	Weight of water.	Prop. per 1000 of mixture.	Time in seconds.
304°	10·4262	0·0153	1·4	1·9
288	7·8216	0·0143	1·8	2·9
302	22·0365	0·0999	4·04	3·77
310	2·9445	0·0319	10·8	11·4
310	2·1365	0·0239	11·2	12·7
310	2·4989	0·0957	38·0	17·2
310	1·6264	0·0587	36·0	30·0
312	1·8322	0·0718	39·2	40·3
305	0·8473	0·0330	38·9	89·5
298	0·6731	0·0249	37·0	187·4

An attempt made to obtain the same results with the apparatus formerly employed by the authors, and lately used by V. Meyer and van't Hoff (in which the mixture is heated in closed tubes, and the contraction ascertained), gave no constant results. The water formed was in each experiment found to be alkaline, action on the glass evidently having taken place. J. F. T.

Dimorphism of Ice. By H. P. BARENDRECHT (*Zeit. anorg. Chem.*, 1896, **11**, 454—455).—Solutions of water in methylic, ethylic, propylic, isopropylic, butyric or allylic alcohol, ether, glycerol, ethylene glycol, and lactic acid when cooled to a low temperature by means of solid carbonic anhydride, yield crystals which are very similar to the well known snow crystals. In mixtures of water with ethylic, propylic, isopropylic or allylic alcohol, besides the hexagonal crystals, large regular crystal skeletons are formed. The two crystal forms could not be separated. From a 60 per cent. solution of acetaldehyde, a crystalline mass which contained 37 per cent. of aldehyde was obtained by means of a centrifugal machine. A similar result was obtained by separating the hexagonal crystals from a 55 per cent. solution of alcohol in water. E. C. R.

An Oxidising Substance produced by distilling Aqueous Solutions of Potassium Permanganate and Sulphuric acid in a Vacuum. By COLIN C. FRYE (*Chem. News*, 1896, **73**, 122).—The author confirms the view generally entertained that when solutions of sulphuric acid and potassium permanganate are distilled in a vacuum, the distillate contains ozone. This does not occur if less than 22 per cent. of each reagent is present or if both solutions are above 50 per cent. in strength, for then large quantities of oxygen are evolved. D. A. L.

Action of some Hydrogen Compounds on Sulphuric Chloride. By ADOLPHE BESSON (*Compt. rend.*, 1896, **122**, 467—469).—Dry hydrogen sulphide acts on sulphuric chloride in the cold with production of hydrogen chloride, sulphurous anhydride, and sulphur, but some sulphur chloride is also formed in proportion which increases with the temperature, water being produced at the same time.

Dry hydrogen bromide at the ordinary temperature or on gently heating, decomposes sulphuric chloride with liberation of bromine and formation of hydrogen chloride and sulphurous anhydride. Hydrogen iodide behaves similarly, but some sulphur is liberated and water formed. Hydrogen phosphide yields hydrogen chloride, a crystalline, yellow phosphide, P_4S_3, and red phosphorus, with phosphorous anhydride and traces of phosphoric chloride, $POCl_3$.

C. H. B.

Sulphur Nitride. By RUDOLF SCHENCK (*Annalen*, 1896, **290**, 171—185).—See this vol., i, 426.

Combination of Atmospheric and Chemical Nitrogen with Metals. By P. L. ASLANOGLOU (*Chem. News*, 1896, **73**, 115—116).—The author has heated magnesium, copper, iron, zinc, and clay in the open air, and magnesium in purified atmospheric nitrogen and in ammonia, with the usual results. Aluminium gave a somewhat similar reaction to magnesium, but not distinctly enough to encourage further work with it. D. A. L.

Hyponitrous acid. By SIMEON M. TANATAR (*Ber.*, 1896, **29**, 1039).—Silver hyponitrite may be prepared, but only in small quantity, by submitting a solution of barium acetate and sodium nitrite to electrolysis, and then acting with silver nitrate on an acetic acid solution of the crystalline barium hyponitrite which is formed. Hyponitrous acid is soluble in ether, and may be extracted from aqueous solution by means of this solvent. An ethereal solution of the acid, prepared by adding a solution of hydrogen chloride in ether to silver hyponitrite suspended in ether, left, on evaporation, a drop of a yellow, oily liquid which did not solidify at −19°, but when dissolved in water gave the characteristic reaction with silver nitrate. A. H.

Thiophosphites. By LUCIEN FERRAND (*Compt. rend.*, 1896, **122**, 621—622).—By heating a mixture of sulphur and red phosphorus, with different metals, a series of compounds of the general formula $PS_3M'_3$ is formed.

Copper thiophosphite, $(PS_3)_2Cu_6$, is made by heating molecular proportions of red phosphorus, copper, and sulphur to a red heat for 20 hours in a closed vessel. It forms crystals of a metallic lustre, red by transmitted light. It is fairly stable, but is decomposed by damp air.

Ferrous thiophosphite, $(PS_3)_2Fe_3$, a black substance crystallising in small plates. It is very stable.

Silver thiophosphite, PS_3Ag_3, is obtained in the same way, it is a black, vitreous mass.

The author has also prepared the thiophosphites of chromium, zinc, and mercury.

Aluminiumthiophosphite, $(PS_3)_2Al_3$, [?PS_3Al], is a white solid, which is very unstable, and cannot be kept in the air. J. F. T.

Argon and Helium. By EDWIN A. HILL (*Amer. J. Sci.*, 1895, [3], **50**, 359—376).—The author replies to some criticisms of his former paper (this vol., ii, 16), and, more particularly, shows that there is little evidence in support of the assumption that argon, as a monatomic gas, can be compared to mercury vapour at 800°. Argon is analogous to the non-metals of low atomic weight and specific gravity rather than to the metals. Compounds are formed from argon on heating, and not on cooling, and the analogy with mercury therefore does not hold. The author thinks it probable that both argon and helium are mixtures. H. C.

Helium and Argon: Their Places among the Elements. By R. M. DEELEY (*Chem. News*, 1895, **72**, 297—298).—In a paper published in 1893 (Trans., 1893, **63**, 852), the author showed that there was a blank for *one* element between hydrogen and lithium, and to this element gave an atomic weight of about 2·5. If helium has a diatomic molecule it would fill this place. The refraction equivalent of argon indicates that this gas is also diatomic, and places it between fluorine and sodium. H. C.

The Place of Helium and Argon in the System of the Elements. By W. PREYER (*Ber.*, 1896, **29**, 1040—1041).—The author points out that helium, with the atomic weight 4, argon, with the atomic weight 20, and the lighter constituent of the gas from

Cleveïte, with the atomic weight of about 2, all find a place in the system of the elements proposed by him, and described in his work *Das genetische System der chemischen Elemente* (Berlin, 1893).

A. H.

The Formation of Sodium Carbonate in Nature. By SIMEON M. TANATAR (*Ber.*, 1896, **29**, 1034—1038).—When calcium carbonate is suspended in a solution of sodium sulphate, and the whole treated with a stream of carbonic anhydride and allowed to remain, sodium hydrogen carbonate is invariably formed. The amount produced is ascertained by filtering off the calcium sulphate and excess of calcium carbonate, boiling the clear liquid, filtering off the calcium carbonate thus deposited, and then titrating the solution with normal acid. The maximum amount of sodium hydrogen carbonate formed in this reaction, when 20 grams of sodium sulphate per litre are taken, is 2·9 grams per litre.

It is probable that sodium carbonate is actually formed in this way in nature, since it is always accompanied by sodium sulphate. Previous investigators have always made use of alcohol to remove the calcium sulphate produced, and have thus introduced an element of uncertainty into the matter.

The solubility of calcium hydrogen carbonate in water, which amounts to about 0·7 gram per litre, is greatly diminished by the addition of sodium hydrogen carbonate. When calcium carbonate is shaken up with a solution of sodium sulphate, the solution becomes alkaline, this being probably due to the increased solubility of the carbonate.

A. H.

Lithium Carbide. By HENRI MOISSAN (*Compt. rend.*, 1896, **122**, 362—363).—Lithium carbide, LiC_2, is obtained as a transparent, white, crystalline mass of sp. gr. 1·65 at 18°, by heating 74 parts of lithium carbonate with 48 parts of sugar-carbon in the electric furnace at not too high a temperature. A current of 350 ampères and 50 volts suffices, and if heating is continued too long, part of the carbide is volatilised and decomposed.

Lithium carbide is a powerful reducing agent; it burns in fluorine and chlorine in the cold, in bromine and iodine vapours on gently heating, in oxygen and in sulphur and selenium vapours below dull redness, and in phosphorus and arsenic vapours at a red heat. Solid oxidising agents when fused attack it with great energy, but concentrated acids have very little action. Water decomposes the carbide in the cold with production of pure acetylene, and the decomposition becomes violent at about 100°.

C. H. B.

Action of Magnesium on Metallic and other Solutions. By DIOSCORIDE VITALI (*L'Orosi*, 1895, **18**, 289—303).—When metallic magnesium acts on aqueous ammonium chloride solution there is an abundant evolution of hydrogen; the metal dissolves, and ammonia is liberated. The older explanation of these facts, that is, that action occurs directly between the metal and the ammonium chloride, seems to be untrue; in all probability the magnesium first acts on the water, with liberation of hydrogen and formation of magnesium hydroxide, and the latter then decomposes the ammonium chloride with liberation of ammonia. The action of magnesium on hydroxylamine hydrochloride supports this view, for hydrogen is liberated in abundance and hydroxylamine remains in solution; similarly mercuric cyanide solution is acted on by magnesium with copious evolution of hydrogen and development of heat; and, if excess of magnesium is used, magnesium cyanide alone remains in solution; in this case the hydrogen can only result from the action of the metal on the water.

The black powder deposited on reducing solutions of gold or platinum chloride with magnesium is partially dissolved by dilute hydrochloric acid, yielding a solution containing the noble metal; in this case also, the first action consists in the formation of magnesium hydroxide, and the liberation of hydrogen which then more or less completely reduces the gold or platinum. On treating a cobalt, nickel, or ferric solution with magnesium, it is easy to see coloured flocks of the respective hydroxides floating in the liquid, and, as the action of the magnesium continues, these are gradually reduced to the metallic state. When magnesium acts on copper sulphate solution, a basic copper sulphate is first precipitated, and the magnesium becomes coated with a black powder; this, on treatment with dilute hydrochloric acid, turns red, and copper goes into solution. Magnesium acts slowly on potassium chloride solution, with formation of caustic potash and magnesium hydroxide; the alkaline liquid contains magnesium in solution. The first action in this case seems also to occur between the metal and the water.

It must, therefore, be concluded that with a few possible exceptions, such as those of lead, silver, and palladium, metallic magnesium does not immediately precipitate the metals from their solutions; the separation of the metals is due to the reduction of their hydroxides or basic salts by the hydrogen resulting from the decomposition of the water.

Potassium arsenite is reduced by magnesium with slow evolution of hydrogen containing hydrogen arsenide, arsenic being deposited. Potassium arsenate is also decomposed with evolution of hydrogen containing hydrogen arsenide, but a white deposit of insoluble magnesium arsenate is formed on the metal. The action of magnesium on arsenious and arsenic acids is very similar. The action of magnesium on the salts of the alkaloïds is quite in accordance with the conclusion stated above.

A slow evolution of hydrogen occurs on treating iodic acid solution with magnesium, and iodine is liberated, owing to reaction occurring between the iodic and hydriodic acids; the yellow colour due to the iodine disappears as the action continues, and the unstable magnesium hypoiodite is precipitated as a red-brown powder. The formation of the latter is due to reaction between magnesium hydroxide and iodine, as may be readily ascertained by direct experiment. Magnesium might well be used for the detection of iodic acid, just as hypoiodites can be used as reagents for magnesium salts.

Considerable quantities of magnesium dissolve in solutions of phenol and the dihydroxybenzenes, and the phenoxides and phenolates of the heavy metals can be readily precipitated from the solutions by double decomposition. W. J. P.

Structure and Constitution of Alloys of Copper and Zinc. By GEORGES CHARPY (*Compt. rend.*, 1896, **122**, 670—672).—Alloys of copper and zinc, containing from 0 to 35 per cent. of the latter, all have the same micrographic characteristics, and the metal obtained by casting, consists of long, dendritic needles, the ramifications of which are often at right angles. If the metal is kept at a temperature somewhat below its melting point the crystals increase in size and distinctness, and take the form of macled octahedra, which are larger the higher the temperature at which the alloy has been heated.

When the proportion of zinc exceeds 34 per cent., the fused metal contains crystallites with rounded edges, but no dendrites, and the crystalline structure does not markedly develop on annealing. With a higher proportion of zinc, the crystallites tend to disappear, and with 45 per cent. the alloy consists of polygonal plates. With 67 per cent. of zinc, the alloy has a conchoidal fracture, and is practically homogeneous, although showing traces of imperfectly formed crystals.

In the alloys of a distinctly crystalline structure (0 to 34 per cent. of zinc), the impurities are localised between the crystals; they seem to consist of isomorphous mixtures of copper with the compound Cu_2Zn. The well-known fragility of brass that has been heated beyond 200° may be attributed to the development of the crystalline structure.

With the alloys containing 36 to 45 per cent. of zinc, this development of crystalline structure does not take place, and it is known that such alloys can be worked when hot; they are probably mixtures of the two compounds Cu_2Zn and $CuZn_2$. Alloys containing more than 67·3 per cent. of zinc are probably mixtures of the compound $CuZn_2$ with zinc. C. H. B.

Properties of Metals separated from their Amalgams. By ANTOINE GUNTZ (*Compt. rend.*, 1896, **122**, 465—467).—Ramsay's experiments on the boiling point of mercury containing metals in solution show that at about 350° the molecular weight of the metals dissolved in the mercury coincide with their atomic weights (Trans., 1889, 521), and Meyer's determinations of the E.M.F. of amalgams show that this is also the case at the ordinary temperature. It follows that if the mercury can be removed from the amalgams at a comparatively low temperature by distillation in a vacuum, the metals will be left more or less completely in an atomic condition. The author has previously shown (Abstr., 1892, 582) that manganese extracted from its amalgam at a low temperature is more energetic than the metal in its ordinary form. Calorimetric determinations show that the heat of oxidation of this pyrophoric form is +3·8 Cals. greater than that of the ordinary metal. Ordinary metals are most probably highly polymerised, and hence show much lower chemical activity than when separated from their amalgams in an atomic, or at any rate in a less highly polymerised condition. Possibly a similar explanation holds good for the pyrophoric metals obtained by reduction.

C. H. B.

New and Abundant Source of the Rare Oxides of Thorium, Cerium, Yttrium, Lanthanum, Didymium, and Zirconium. By THOMAS L. PHIPSON (*Chem. News*, 1896, 145).—By heating finely pulverised Norwegian granite containing pink and white felspar and black mica with pure hydrochloric acid, diluting, nearly neutralising with ammonia, and adding excess of crystalline oxalic acid, which is dissolved by stirring, a precipitate is obtained containing cerium, zirconium or thorium, or both, and yttrium or lanthanum. The solution when quite neutralised with ammonia and treated with excess of oxalic acid, yields a further precipitate containing cerium, didymium, lanthanum, and yttrium. Nearly 2 per cent. of rare oxides and carbonates have been obtained in this way from the granite.

D. A. L.

Cerium Carbide. By HENRI MOISSAN (*Compt. rend.*, 1896, **122**, 357—362).—Cerium carbide, C_2Ce ($Ce = 140$), is obtained as a reddish-yellow, crystalline, transparent substance of sp. gr. 5·23, by heating an intimate mixture of white cerium dioxide with one quarter of its weight of sugar carbon in the electric furnace until evolution of gas ceases and the product remains in quiet fusion. A current of 300 ampères and 60 volts will reduce 100 grams of the oxide in 8 or 10 minutes, whilst a current of 900 ampères and 50 volts will reduce 600 grams in three minutes. The carbide is not attacked by fluorine in the cold, but burns brightly in it on gently heating; it burns in chlorine at 220°, and in bromine and iodine vapours at somewhat higher temperatures, in oxygen and in sulphur vapour at a red heat, and in selenium vapour below dull redness. Phosphorus vapour or nitrogen has no action at the softening point of glass. Hydrogen chloride attacks the carbide at 650°, and hydrogen iodide at a higher temperature; hydrogen sulphide decomposes it at a red heat, but ammonia forms no nitride at 600°. Oxidising agents attack the carbide very readily, and fused alkali nitrates, chlorates, hydroxides, or carbonates decompose it with great energy. Concentrated sulphuric acid is reduced on heating, but concentrated nitric acid is without action.

Water decomposes the carbide with formation of cerium hydroxide and evolution of a gas which contains about 75 per cent. of acetylene, 4 per cent. of ethylene, and 21 per cent. of methane. Dilute acids behave similarly, and in all cases the proportion of acetylene varies with the conditions under which decomposition takes place.

C. H. B.

Carbides of Yttrium and Thorium. By HENRI MOISSAN and ÉTARD (*Compt. rend.*, 1896, **122**, 573—580).—Yttria, which occurs together with the oxides of erbium, holmium, thulium, &c., in the minerals gadolinite, euxenite, and monazite, can be separated from them by treatment with sulphuric acid, and fractionally precipitating the dissolved metals as basic chromates, 10 fractions being taken; the last contains the yttrium; this is then converted into the oxalate, and finally into the oxide by ignition.

The yttria thus formed is powdered, mixed with sugar charcoal, and made into a paste with turpentine; it is then heated in the electric furnace for five or six minutes, a current of 900 ampères and 50 volts being employed.

Yttrium carbide, YC_2, forms fusible ingots showing a crystalline structure. Its density is 4·13 at 18°. Halogens act on it readily in the cold; it burns in oxygen and in the vapour of sulphur or of selenium, and is readily attacked by acids.

Water decomposes it with the production of a mixture of gases having the composition C_2H_2, 71·7; CH_4, 19·0; C_2H_4, 4·8; H, 4·5; total, 100·0.

Thorium oxide occurs associated with iron and the metals of the cerium and yttrium groups in thorite and in orangite. The solution of the mixed oxides in hydrochloric acid is precipitated by means of oxalic acid, and the precipitate washed free from iron, &c. On treating the residual oxalates with a solution of ammonium oxalate, the thorium alone dissolves, and is separated by filtration.

Thorium carbide, ThC_2, is produced in an analogous manner to the yttrium carbide, heating for four minutes, however, sufficing; it is a fusible, crystalline substance of sp. gr. = 8·96 at 18°, and closely resembles yttrium carbide in its properties; concentrated acids have, however, little action on it; in dilute acids it dissolves readily. Cold water decomposes it with the production of a mixture of gases having the composition

	C_2H_2.	CH_4.	C_2H_4.	H.
I.	47·05	31·06	5·88	16·01
II.	48·44	27·69	5·64	18·23

J. F. T.

Deposition of Aluminium from Aqueous Solutions. By HENRY N. WARREN (*Chem. News*, 1896, **73**, 123).—Aluminium hydroxide is dissolved in hydrochloric acid, a large excess of tartaric acid is added, and then ammonia until a clear solution is obtained. Employing an aluminium or carbon positive electrode, a brass negative electrode, and a current of 9 ampères and 12 volts in this solution, the brass becomes plated with aluminium, and can be burnished, but when once the surface is covered, further deposition is considerably retarded.

D. A. L.

Alumina in Glass. By LÉON APPERT (*Compt. rend.*, 1896, **122**, 672—673).—The presence of alumina in glass prevents, or at any rate retards the devitrification which results from repeated heating. It also allows part of the potassium or sodium to be replaced by calcium with distinct advantages as regards solidity, resistance, and elasticity. Alumina can be substituted for silica to an extent not exceeding 7 or 8 per cent., and the glass becomes slightly more fusible, but its malleability is not appreciably affected. The only disadvantage arising from the introduction of the alumina is the increased colour due to its action on the ferric oxide. Pure clay or felspar is a convenient form in which to introduce the alumina. C. H. B.

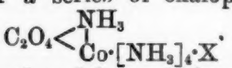
Manganese Carbide. By HENRI MOISSAN (*Compt rend.*, 1896, **122**, 421—423).—The manganese carbide, Mn_3C, described by Troost and Hautefeuille, is obtained by heating a mixture of trimanganese tetroxide with one quarter of its weight of sugar carbon in a carbon tube, closed at one end, in the electric furnace with a current of 350 ampères and 50 volts. The reaction is complete in a few minutes. The sp. gr. of the carbide is 6·89 at 17°. Fluorine attacks it in the cold, and chlorine on gently heating, hydrogen chloride below a red heat, and ammonia at a dull red heat, with production of a nitride. When gently heated, it burns in oxygen, nitrous oxide, or nitrogen peroxide. Dilute acids attack it readily with formation of liquid hydrocarbons, and water decomposes it with evolution of methane and hydrogen in practically equal volumes, neither liquid nor solid hydrocarbons being formed. C. H. B.

Nickel and Cobalt Borides. By HENRI MOISSAN (*Compt. rend.*, 1896, **122**, 424—426).—Nickel boride, NiB, and cobalt boride, CoB, can be obtained by heating their constituents in crucibles, brasqued with boron, in an electric furnace with a current of 300 ampères and 50 volts, or in a reverberatory furnace fed with gas carbon. The product is treated with dilute nitric acid, and the borides are obtained in brilliant prisms which are often several mm. long, are magnetic, and about as hard as quartz. The sp. gr. of the nickel compound is 7·39 at 18°, and of the cobalt compound 7·25. They are attacked by chlorine at a dull red heat, by bromine at a higher temperature, and by iodine at the softening point of glass. They are not affected by dry air or oxygen, but alter rapidly in moist air, especially in presence of carbonic anhydride. Fused alkali chlorates, nitrates, hydroxides, or carbonates dissolve and decompose them; water vapour at a dull red heat converts them into oxides and boric acid, and acids, concentrated or dilute, attack them with varying degrees of readiness.

The nickel and cobalt borides are analogous to the iron borides previously described, and may likewise be used for introducing boron into a metal such as iron (compare Abstr., 1895, ii, 220 and 270).

C. H. B.

Constitution of Cobalt, Chromium, and Rhodium Bases. VII. By SOFUS M. JÖRGENSEN (*Zeit. anorg. Chem.*, 1896, **11**, 416—453; see also Abstr., 1895, ii, 47).—The acid oxalo-sulphate of purpureocobalt described by Gibbs and Genth (*Smithson. Contrib.*, 1856, 32) is the sulphate of a series of oxalopurpureo-salts, which have the general formula



$$C_2O_4<\begin{matrix}NH_3\\ | \\ Co\cdot[NH_3]_4\cdot X\end{matrix}$$

The normal oxalo-sulphate of these authors has not the constitution assigned to it by them, but is a normal oxalopurpureosulphate; also the acid roseo-oxalate of Gibbs is an acid oxalopurpureo-oxalate, and yields an oxaloplatinochloride, which is not identical with roseocobalt-oxalate platinochloride.

Pentamine-oxalopurpureocobalt salts are obtained by boiling the pentamine roseo-salts with a solution of oxalic acid; also by precipitating the solution obtained by boiling roseo-oxalates with oxalic acid, by the addition of various acids. They are especially prone to form acid salts, which are converted into the normal salts by the addition of ammonia. The *acid sulphate*, $C_2O_4(Co5NH_3)\cdot SO_4H,H_2O$, is obtained by dissolving equal weights of the roseosulphate and oxalic acid in warm water and evaporating the solution to crystallisation on the water bath; also by adding dilute sulphuric acid to a solution of the acid oxalate and precipitating with 95 per cent. alcohol; also by heating a solution of the roseo-oxalate with oxalic acid on the water bath, adding dilute sulphuric acid to the cold mixture and then precipitating with alcohol. It crystallises in red leaflets, sometimes with $2H_2O$. It dissolves in dilute hydrochloric acid with a violet coloration, being completely converted into the chloropurpureochloride. It is not dissolved by cold cencentrated ammonia; when boiled with dilute ammonia, it dissolves, but is not converted into the roseo-salt. With concentrated hydrobromic acid, a voluminous precipitate of the acid oxalopurpureobromide is obtained; it dissolves in 100 parts of cold water. The solution has an acid reaction, gives a voluminous precipitate with barium chloride and hydrochloric acid, but is not precipitated by calcium acetate. The *platinochloride* crystallises in reddish needles, the *aurochloride* in lustrous red, rhombic plates. The *normal sulphate*, $[C_2O_4(Co5NH_3)]_2SO_4,3H_2O$, crystallises in rose-red, microscopic needles, is sparingly soluble, has a neutral reaction, and gives the same compounds with sodium platinochloride and sodium aurochloride as the acid sulphate. The *acid oxalate*,

$$[C_2O_4(Co5NH_3)]_2C_2O_4,4C_2H_2O_4,$$

crystallises in red, six-sided tablets, the *normal oxalate* is a deep red precipitate consisting of very small octahedra, and is quite insoluble in cold water. The corresponding *iodides*, *chlorides*, *bromides*, and *nitrates* are also described.

Tetramine-oxalopurpureocobalt chloride, $C_2O_4\colon Co(NH_3)_4Cl$, is obtained by heating the aquotetramine chloride with oxalic acid and water on the water bath. The salt, which completely crystallises out on cooling, is washed with 50 per cent. and then with 95 per cent. alcohol. The crude aquotetramine chloride can be employed, since the praseochloride which is present is also converted into tetramine-oxalopurpureocobalt chloride, and a small quantity of pentamine purpureochloride is converted into acid *p*-oxalopurpureocobalt oxalate, which remains in the mother liquor. It crystallises in lustrous, carmine rhombic tablets, is not converted into roseo-salt when boiled with ammonia, dissolves in 140 parts of cold water with a carmine coloration and neutral reaction, and when shaken with freshly prepared silver oxide yields a strongly alkaline solution, containing tetramine-oxalopurpureocobalt hydroxide. This salt is identified as a tetramime oxalopurpureo-salt by the following reactions. The aqueous solution, when treated with silver nitrate, yields all its chlorine as silver chloride. It is not precipitated by calcium acetate and a small quantity of acetic acid. When dissolved in cold concentrated sulphuric acid and treated with concentrated hydrochloric acid it is converted into the praseochloride, which is reconverted into the original salt when heated with oxalic acid. The *platinochloride*, $[C_2O_4\colon Co(NH_3)_4]_2PtCl_6 + H_2O$, crystallises in scarlet quadratic tablets, and is insoluble in water and alcohol. The *platinosochloride*, $[C_2O_4\colon Co(NH_3)_4]_2PtCl_4 + 1\frac{1}{2}H_2O$, the *chloride*, *bromide*, *sulphate*, and *oxalate* are also described.

The *salt*, $C_2O_4\colon[Co(NH_3)_3]\cdot Cl + \frac{1}{2}H_2O$, is obtained by gently warming the dichrochloride with a solution of oxalic acid, or by allowing the dichrochloride to remain in the cold with a concentrated solution of oxalic acid in water or dilute alcohol. It is an indigo-blue precipitate consisting of dichroitic rhombic tablets, and, when allowed to remain under water and exposed to light, dissolves sparingly with a red coloration.

When ammonium-diaminecobalt nitrite, dissolved in hot water, is heated with a saturated solution of oxalic acid for a few minutes on the water bath, nitrogen and oxides of nitrogen are evolved, and a brown crystalline precipitate is obtained which is most probably a *double salt* of the composition

$$[(NO_2)_2Co(NH_3)_2{\cdot}C_2O_4]_2Co,(NO_2)_2{\cdot}Co(NH_3)_2{\cdot}C_2O_4{\cdot}NH_4 + 9H_2O.$$

It crystallises in microscopic rhombic tablets, is soluble in 280 parts of cold water, and has a neutral reaction. When precipitated with a luteocobalt salt, it yields a salt of the composition

$$[Co6NH_3][Co_3(NO_2)_6(NH_3)_6(C_2O_4)_3] + 6H_2O.$$

When treated with sodium hydroxide out of contact with the air, it yields a greenish-blue precipitate, which, on warming, is converted into red cobaltous hydroxide. The *silver salt*, with $9H_2O$, forms brown crystals similar to the ammonium salt, and contains 1Ag to 4Co. The *luteo-salt* is precipitated by adding various soluble luteo-cobalt salts to the cold saturated solution of the ammonium-cobalt salt. It crystallises with $6H_2O$, and when warmed with dilute nitric acid all the cobalt present as luteocobalt is precipitated as luteocobalt nitrate. The cobalt in the luteocobalt is to the cobalt in the complex salt as 1 : 3.

Ammonium-dinitrodiaminecobalt oxalate,

$$(NO_2)_2Co(NH_3)_2{\cdot}C_2O_4{\cdot}NH_4 + H_2O,$$

is obtained by mixing a solution of the ammonium-diamine nitrite with a solution of oxalic acid, both at 50°. Nitrogen and oxides of nitrogen are evolved, and the ammonium-cobalt salt is precipitated; after a time, more of the ammonium salt separates in larger crystals. The mixture is filtered, the ammonium salt washed out of the precipitate with cold water, and the solution mixed with the filtrate. The solution of the ammonium salt is then precipitated by the addition of ammonium chloride and washed with alcohol. It crystallises in rhombic prisms, dissolves with a beautiful brown coloration and neutral reaction in 30 parts of cold water, dissolves without change in dilute hydrochloric acid, and yields with solutions of metallic salts, brown crystalline precipitates. The *free acid* is obtained by treating the silver salt with hydrochloric acid. It reacts strongly acid, precipitates silver nitrate, and, when evaporated over sulphuric acid, is gradually decomposed with formation of the ammonium cobalt salt. The *sodium*, *silver*, *potassium*, *barium*, *ammonium-magnesium*, *ammonium cobalt*, and *luteocobalt* salts are described.

E. C. R.

Chromous Ammonium Carbonate. By GEORGES BAUGÉ (*Compt. rend.*, 1896, **122**, 474—477).—Chromous ammonium carbonate,

$CrCO_3,(NH_4)_2CO_3 + H_2O$, is obtained as a yellow, crystalline powder by passing carbonic anhydride into an ammoniacal solution of chromous acetate, or by boiling the solution with sodium carbonate. It is a powerful reducing agent, and alters rapidly in presence of air and moisture, although comparatively stable when carefully dried. Chlorine attacks the salt at a dull red heat, and hydrogen sulphide at a somewhat lower temperature converts it into black, crystalline chromium sesquisulphide. In absence of oxygen, dilute sulphuric and hydrochloric acids dissolve the carbonate, forming blue solutions.

C. H. B.

Preparation of Pure Molybdenum. By AD. VANDENBERGHE (*Zeit. anorg. Chem.*, 1896, **11**, 385—396).—An examination of the method for preparing pure molybdenum, described by Berzelius and Débray, which consists in reducing the pure trioxide in a current of hydrogen, shows that it is not without errors. When platinum vessels are employed, the molybdenum contains platinum and the vessels are contaminated with molybdenum; when porcelain is employed, the molybdenum contains distinct traces of molybdenum silicide. In order to remove these traces of silicon, the product must be washed with hydrofluoric acid, hydrochloric acid, and water, and dried in a vacuum. The product, which contains traces of the lower oxides of molybdenum, cannot be purified by heating in a current of dry hydrogen chloride; after heating the product at 200° in hydrogen chloride and then passing air through the apparatus until the evolved gas showed no traces of chlorine, the molybdenum was found to contain a distinct trace of chlorine. A sample of the molybdenum was then partially oxidised by heating in the air and treated with dry hydrogen chloride at 200°, when the result showed that only part of the lower oxides are removed by this method. When heated in dry hydrogen chloride at 500—600°, a reddish product is formed which is probably an oxychloride, and small quantities of hydrogen are evolved. Crystalline molybdenum dioxide, prepared by fusing a mixture of ammonium molybdate, molybdenum trioxide, borax, and potassium carbonate, is not altered even when heated very strongly in dry hydrogen chloride. The results show that by this method of purification only molybdic anhydride and oxides of the molybdenum molybdate type are eliminated.

The method described by von der Pfordten (Abstr., 1884, 965), which consists in the reduction of molybdenum polysulphide in a current of hydrogen is only applicable when a few centigrams of the polysulphide are employed. Employing 15 grams of the dry polysulphide, the author finds that, after heating for 48 hours at a very high temperature, the product still contains traces of sulphur.

The reduction of calcium molybdate by heating it with carbon yields a product containing about 8 per cent. of carbon; Moissan's pure molybdenum, prepared by heating molybdenum oxide and carbon in the electric furnace, contains 0·08 to 0·28 per cent. of impurities.

The author reserves for future communication the description of a method for the preparation of chemically pure molybdenum.

E. C. R.

Action of Certain Gases on Heated Molybdenum. By Ad. Vandenberghe (*Zeit. anorg. Chem.*, 1896, **11**, 397—403).—Pure dry hydrogen is without action on finely divided molybdenum. After heating a sample for two hours at the highest temperature of the furnace, no alteration in weight could be detected, and no formation of water was observed when the sample was further heated in a current of oxygen. Pure dry nitrogen is also without action on molybdenum. When molybdenum is heated at 200° in a current of pure dry carbonic anhydride, the latter is reduced to carbonic oxide and the molybdenum becomes covered with brown flakes. This is probably a reversible reaction as expressed in the equation $MoO_3 + CO \rightleftarrows CO_2 + Mo$, for Muthmann (*Annalen*, **238**, 123) states that molybdic anhydride is reduced by carbonic acid not only to the lower oxides, but at higher temperatures to metallic molybdenum.

E. C. R.

Atomic Weight of Tungsten. By E. Robert Schneider (*J. pr. Chem.*, 1896, [2], **53**, 288—303).—The author's determinations of the atomic weight of tungsten (*J. pr. Chem.*, 1850, **50**, 152) by the reduction of tungstic acid in hydrogen and by the oxidation of tungsten in the air, lead to a mean value of 184·12. Later, Marchand found 184·1, and this was confirmed by Dumas. Recently Pennington and Smith and Smith and Desi (Abstr., 1895, ii, 230) have given the values 184·92 and 184·70 by the oxidation method and the reduction method respectively. They account for the fact that their numbers are higher than that formerly accepted by supposing that the tungstic acid previously used contained molybdic acid. The author points out that this is extremely improbable; for if it were the cause of difference there would have had to be 1 per cent. of molybdic acid present, an amount which he could not have overlooked. To assure himself of the accuracy of his former work, he has repeated the experiments, and as a mean of three oxidations and three reductions, has obtained the value 184·01, and has satisfied himself as to the absence of molybdic acid. In criticising the work of Pennington and Smith, the author points out that they have neglected the sole means available for the detection of constant errors, namely, the use of widely differing weights of the material experimented with. Furthermore, they ignited their tungsten to oxide in an open crucible for 10 hours, and they neglected to use a surface counterpoise while weighing. Analogous errors underlie the work of Smith and Desi.

A. G. B.

A New Zirconium Carbide. By Henri Moissan and Lengfield (*Compt. rend.*, 1896, **122**, 651—654).—In order to obtain zirconium oxide, powdered zircon is mixed with sugar-carbon, and heated in a carbon crucible in the electric furnace for 10 minutes with the arc from a current of 1000 ampères and 40 volts. The greater part of the silica volatilises and impure zirconium carbide is left. This is heated in chlorine, and the mixture of zirconium chloride with iron and silicon chlorides is boiled with concentrated hydrochloric acid, and almost pure zirconium chloride separates. After further purification, it is converted into oxide by precipitation.

Zirconium carbide, ZrC, is obtained by placing a mixture of the oxide with sugar-carbon in a carbon tube closed at one end and heating it in the electric furnace with an arc from a current of 1000 ampères and 50 volts. It has a grey colour and a metallic lustre, scratches quartz but not rubies, and is not attacked by dry or moist air even at 100°. It burns in fluorine in the cold, chlorine at 250°, bromine at 300°, and iodine at about 400°, and it is readily attacked by halogen hydracids. At a dull red heat, it burns brilliantly in oxygen, and is slightly attacked by sulphur vapour at the same temperature. Water, ammonia, and hydrochloric acid do not attack the carbide even when strongly heated. Nitric and sulphuric acids attack it, and oxidising agents such as potassium chlorate, nitrate, or permanganate, as well as the hydroxide, decompose it readily, but fused potassium cyanide is without action. C. H. B.

Action of Nitric Peroxide and Air on Bismuth Chloride. By V. Thomas (*Compt. rend.*, 1896, **122**, 611—613).—On passing dry nitric peroxide over bismuth chloride, also carefully dried, contained in a weighed flask, it is readily absorbed, the chloride becoming yellow. The compound, $BiCl_3NO_2$, is yellow, and is readily decomposed by water and moist air.

The action of this gas at higher temperatures is, however, quite different, the chloride being then oxidised to the oxychloride. To this oxychloride the author attributes the formula BiOCl, and not $Bi_3Cl_3O_2$. J. F. T.

Fusibility of Platinum in a Wind Furnace fed with Carbon. By Victor Meyer (*Ber.*, 1896, **29**, 850—852).—It has never previously been proved that platinum can be fused by the heat of a wind furnace fed with carbon, when it is so situated as to be protected from the gases produced by the combustion, and from particles of carbon (Hecht, *Chem. Zeit.*, 1896, 85). This was, however, accomplished by the author, who enclosed the platinum in a cavity in a piece of fire-resisting clay, and exposed the whole to the heat of a wind furnace fed with retort graphite. On breaking open the mass after the experiment, the platinum was found in the form of a sphere, whilst a piece of platinum-iridium alloy, containing 25 per cent. of iridium, which had been placed in an adjoining cavity in the block, was quite unaltered in shape and lustre. A. H.

Mineralogical Chemistry.

Native Gold from Eule, Bohemia. By Franz Štolba (*Verh. k. k. geol. Reichsanst.*, 1893, 64; from *Böhm. Zeits. chem. Indust.*, 1893, **3**, 1).—The native gold which occurs as threads, grains, and scales, together with pyrites, mispickel and stibnite, in quartz and calcite veins in the Archæan rocks at Eule, Bohemia, gave the following results on analysis.

Au.	Ag.	Fe.	Cu.
91·34	8·42	0·16	0·02

The purest gold from this locality contains 95·8 per cent. Au.

L. J. S.

Microchemical Reactions of Minerals of the Lamprite Group. By JOHANN LEMBERG (*Zeits. deutsch. geol. Ges.*, 1894, **46**, 788—799).—This group includes opaque, lustrous minerals; those treated of being mostly sulphides, but also arsenic, arsenolite, tetrahedrite, and pharmacolite. The action of an alkaline bromine solution and of a silver sulphate and sulphuric acid solution on each of these minerals, when in polished sections, is described in detail; the variations in the reactions being sufficient to be used for purposes of discrimination. With the bromine solution, some minerals are dissolved, others are very slowly attacked, whilst others are oxidised. With the silver solution, metallic silver or silver sulphide, or both, are deposited on the minerals.

L. J. S.

Quiroguite. By (L.) FERNÁNDEZ NAVARRO (*Anales Soc. Española Hist. Nat.*, 1895, **24**, Actas 96—100).—This mineral, named after F. Quiroga, occurs with anglesite, siderite, and pyrites, at the mines San Andrés, Georgiana, Paraíso, &c., in the Sierra Almagrera, Spain. From the habit of the pyramidal crystals the system is given as tetragonal, but some of the measured angles agree closely with those required for cubic symmetry; and Schrauf suggests that the crystals are probably only galena, in which eight of the faces of a triakis-octahedron are developed to the exclusion of the remainder, thus forming an acute square pyramid. The basal cleavage is, however, stated to be more perfect than the two which are perpendicular to it; and thermal conductivity experiments are said to support the view that the mineral is tetragonal. Colour, lead-grey; sp. gr. 7·22; H = 3. Analysis by F. Soria gave

Pb.	Sb.	Fe.	S.	Ag.	Total.
63·89	9·69	6·30	17·51	trace	97·39

From this is deduced $(PbS)_{30},(Sb_2S_3)_4,(FeS)_{11}$, or, as pyrites was seen enclosed in the crystals, $(PbS)_{23},(Sb_2S_3)_3$.

L. J. S.

Composition of Bauxites. By FRANCIS LAUR (*Trans. Amer. Inst. Min. Eng.*, 1895, **24**, 234—242).—Although the commercial bauxites vary considerably in composition and physical characters, it is pointed out that the alumina is fairly constant (66—69 per cent.) and that the sum of the variable constituents, water, silica, and ferric oxide, is also constant (27 per cent.); the various accessory constituents (titanium, vanadium, &c.) also showing a constant total of 3 or 4 per cent. According as the amount of the variable constituents vary, the following types are distinguished.

Pure or hyaline bauxite	$Al_2O_3 + 2H_2O +$	accessories.
Pale bauxite of Villeveyrac	$Al_2O_3 + (\frac{1}{2}H_2O,\frac{1}{2}SiO_2) +$	,,
Maximal siliceous bauxite	$Al_2O_3 + SiO_2 +$	,,
Red bauxite of Var	$Al_2O_3 + (\frac{1}{2}H_2O,\frac{1}{2}Fe_2O_3) +$	,,
Maximal ferruginous bauxite	$Al_2O_3 + Fe_2O_3 +$	,,
Mixed bauxite of Baux	$Al_2O_2 + (\frac{1}{3}H_2O,\frac{1}{3}SiO_2,\frac{1}{3}Fe_2O_3) +$	accessories.

The hydrate thus passing hypothetically into silicate and aluminate.

L. J. S.

Hæmatite from Elba. By R. Rohrer (*Tsch. Min. Mitth.*, 1895, **15**, 184—187).—In the following analyses, the mineral was reduced by hydrogen.

	Fe_2O_3.	SiO_2.	CaO.	MgO.	Total.
I.	98·58	0·51	0·38	0·73	100·20
II.	98·63	0·47	0·45	0·74	100·29

Manganese and ferrous iron are absent, and there is no loss on ignition. In the same volume (p. 68), E. A. Wülfing gives the refractive indices and the sp. gr. (5·285) for the same material.

L. J. S.

Magnetic Iron Hydroxide. By H. Bernhard Kosmann (*Zeits. deutsch. geol. Ges.*, 1893, **45**, 508—509).—Brown iron ore, occurring with chrome iron ore at Harteberg, near Grochau, in Silesia, gave, on analysis,

Fe_2O_3.	Al_2O_3.	MnO_2.	(Co,Ni)O.	Cr_2O_3.	CaO.	MgO.
32·20	17·10	2·00	0·04	0·41	0·03	0·02

SiO_2.	H_2O (at 150°).	H_2O (on ignition).	Total.
36·94	8·01	2·40	99·16

The mineral is strongly magnetic, this property being ascribed to a "peculiar molecular grouping," as ferrous oxide is absent.

L. J. S.

Analyses of Bavarian Minerals, &c. By Adolph Schwager and C. Wilhelm von Gümbel (*Geognost. Jahresh., München*, 1895, **7**, 57—94).—Numerous analyses are given of ores, impure minerals, rocks, coals, waters, lake muds, laterite, loess, &c., mostly from Bavarian localities. The following are of interest.

Ilmenite.—Large tables, surrounded by white leucoxene, in a light-coloured diabase-like rock (leucophyre) from Köditz, in the Fichtelgebirge.

TiO_2.	$FeO(Fe_2O_3)$.	MnO.	MgO.	Total.
46·33	48·85	1·27	1·84	98·29

Fahlore (Tennantite).—Light-coloured, from Hüttau, Salzburg.

Cu.	Fe.	Zn.	Ni,Co.	S.	As.	Sb.	Total.
46·65	6·56	0·71	0·11	28·21	13·94	4·65	100·83

Orthoclase.—I, porphyritic, twinned crystals, in granite, from Ochsenkopf; II, as lenticular aggregations with quartz and chlorite in phyllite, from Rehau; III, whitish, and IV, reddish, in pegmatite, from Wellerthal; all in the Fichtelgebirge.

Labradorite.—V, in a gabbro-like rock, from Eschelkamm, Oberpfalz.

Diallage.—VI, blackish-brown, with numerous dark lamellate enclosures; from the same rock as V.

Muscovite.—VII, large plates from the pegmatite of Wellerthal (Nos. III and IV).

Hygrophilite.—VIII, white nodules in a red clay slate, from Reuschbach, Rhenish Bavaria; in water it falls to very fine scales; incompletely dissolved by caustic potash, probably owing to the presence of impurities.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII.
SiO_2....	65·50	64·50	65·12	65·04	53·41	51·14	45·28	56·64
TiO_2....	—	—	—	—	—	4·01	—	—
Al_2O_3 ..	19·82	19·41	19·56	19·23	29·22	4·06	37·59	26·68
Fe_2O_3...	0·12	1·49	0·16	0·16	1·27	7·69	1·18	1·68
FeO....	—	—	—	—	—	4·01	—	—
MnO ...	—	—	—	—	—	1·12	—	0·12
CaO....	0·11	0·88	0·26	0·22	12·11	20·44	0·09	0·22
BaO....	0·31	—	—	—	—	—	—	—
MgO ...	0·07	0·02	0·09	0·09	0·44	8·16	0·17	0·29
K_2O ...	12·64	13·97	12·96	13·25	0·49	—	10·32	5·33
Na_2O...	1·77	0·69	2·16	1·74	3·17	—	1·20	0·64
Loss on ignition	0·32	0·30	0·32	0·36	0·33	0·35	4·12	7·13
Cl.....	0·01	—	—	—	—	—	—	—
Total..	100·67	101·26	100·63	100·09	100·44	100·98	99·95	98·73
Sp. gr...	2·580	—	2·572	to 2·580	2·702	3·251	2·930	2·415 2·554

Analyses are also given of sericite, chlorites, analcite, dopplerite, &c.

L. J. S.

Pyroxene from Renfrew. By Ernst A. Wülfing (*Tsch. Min. Mitth.*, 1895, **15**, 29—48).—A specimen labelled "hedenbergite, Renfrew, New Jersey," is shown to differ in its optical characters from the diopside-hedenbergite series. There is a strong dispersion of the acute bisectrix, which it is suggested may be connected with the presence of sesquioxide bases. After separating the numerous brown inclosures, the mean of two analyses gave

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	Total.	Sp. gr.
49·94	4·25	4·76	5·15	0·50	23·29	12·54	100·43	3·38

The small amount of sodium and combined water present may occur in an acmite molecule, which will account for the 1·44 per cent. of SiO_2 in excess of that required by the formulæ RO,SiO_2, and RO,R_2O_3,SiO_2. The optical constants for light of various wavelengths are determined; the extremes are

Light.	Extinction angle ($\mathfrak{c}:a$).	2V.	α.	β.	γ.
B.....	60° 58′	61° 34′	1·6928	1·6990	1·7169
G.....	59 51	59 12	1·7218	1·7278	1·7467

L. J. S.

Albite from Crete. By C. VIOLA (*Tsch. Min. Mitth.*, 1895, **15**, 135—158).—The colourless, transparent crystals of albite from Lakous, Island of Crete, are of interest as being almost pure $NaAlSi_3O_8$. The crystallographic constants are given as $a:b:c = 0·635:1:0·557$; $\alpha = 94° 14' 30''$, $\beta = 116° 31' 45''$, $\gamma = 88° 5' 1''$ the optical constants as, extinction on b, $21\frac{1}{2}°$; on c, $3\frac{1}{2}°$; 2E = 123° 2′.

The analysis by E. Mattirolo gave

SiO_2.	Al_2O_3.	Na_2O.	K_2O.	Loss on ignition.	Total.	Sp. gr.
68·51	19·83	11·74	0·16	0·15	100·39	2·621

Traces of magnesia, iron, and manganese are due to microscopic enclosures of chlorite, which also, together with commencing decomposition in places, accounts for the loss on ignition. L. J. S.

Zoisite from Styria. By ST. LOVREKOVIĆ (*Mitth. Ver. Steiermark*, 1893, **29**, 296—306).—In the zoisite-amphibolite and the zoisite-garnet-amphibolite of Deutsch-Landsberg are veins of zoisite containing also quartz, hornblende, and here and there mica and epidote. The needles of zoisite from these veins gave, on analysis,

SiO_2.	CaO.	FeO.	Al_2O_3.	Loss on ignition.	Total.
42·05	18·92	6·49	29·97	2·53	99·96

L. J. S.

Wernerite (Dipyre) from Breno, Lombardy. By WILHELM SALOMON (*Tsch. Min. Mitth.*, 1895, **15**, 159—183).—In the Trias limestones around the mass of igneous rock (tonalite) of the Adamello Mountains, are found two varieties of scapolite; one occurs as black, or dark-green, regular prisms, without end-faces, in more or less aluminous limestones, sp. gr. 2·668; the other as colourless, irregular prisms, resembling tremolite, in a granular marble; sp. gr. 2·68. Analysis of the former, on material separated by means of hydrochloric acid and heavy solutions, gave

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	Loss on ignition.	Total.
52·74	23·98	0·40	7·43	2·77	1·86	9·00	1·18	99·36

Cl, SO_4, and CO_2 were not determined. This gives the formula $3(Ca,Mg,Na_2,K_2)O,2Al_2O_3,8SiO_2$, or Me_5Ma_7, that is, the meionite and marialite molecules in the proportion 5 : 7). The calcite enclosures are often as elongated rods parallel to the vertical axis of the crystal, and are mostly collected in the centre or in zones. The mineral, which is associated with magnetite, pyrites, pyrrhotite, muscovite (?), tremolite, and wollastonite, is confined to the outer zone of metamorphism, 700—1500 metres from the igneous mass; the inner zone containing garnet, idocrase, &c., but no dipyre.

A summary is given of the literature of "dipyre," and from the various analyses the formulæ $MeMa_3$, $MeMa_2$, MeMa, and Me_5Ma_7 are derived, thus showing that scapolite minerals described under this name belong partly to wernerite (of Dana), and partly to mizzonite, and that the name "dipyre" can only be applied to crystals of a certain habit, namely, thin prisms which are seldom terminated and are generally opaque. L. J. S.

Moldavite from Bohemia. By JOSEPH HANAMANN (*Verh. k.k. geol. Reichsanst.*, 1894, 194; from *Böhm. Zeits. chem. Indust.*, 1893, **3**, 365).—Moldavite from Wittingau gave, on analysis,

SiO_2.	Al_2O_3.	FeO.	MnO.	CaO.	MgO.	K_2O.
81·20	9·65	2·25	0·11	2·65	1·80	2·34

The glassy, transparent masses are of a dark olive green, and contain numerous gas-pores; sp. gr. 2·355, H = 7. It is regarded as an obsidian (pseudochrysolite) derived by the metamorphism of glassy felspar rich in silica. The peculiar puckered surface is taken to show that the masses are not water-worn pebbles. (Compare Abstr., 1894, ii, 241.) L. J. S.

Glauconite from Co. Antrim. By A. PERCY HOSKINS (*Geol. Mag.*, 1895, [4], **2**, 317—321).—Dark green grains (rather less than 1 mm. diameter) of glauconite separated from a calcareous sandstone in the Upper Greensand at Woodburn, Carrickfergus, Co. Antrim, gave, on analysis,

SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
40·00	13·00	16·81	10·17	1·97	1·97	8·21	2·16	6·19	100·48

Here the percentage of silica is lower than usual. The variations in composition of glauconite are discussed. L. J. S.

Cobalt in the Sands of Woluwe-Saint-Lambert. By J. CROCQ *Bull. Acad. Belg.*, 1894, [3], **28**, 485—498).—In the tertiary sands of the parish of Woluwe-Saint-Lambert, near Brussels, is a blackish or brownish substance coating the grains of sand; the sand thus blackened (with about 1—7 per cent. of the black substance) occurs as spots, beds, or more often in stem-like forms, evidently due to the infiltration of water from which the black substance was deposited. Analysis I is of the dark green hydrochloric acid solution of one sample; when this material is boiled with sulphuric acid, a purple coloured solution is obtained, showing the presence of Mn_3O_4; formula, $Fe_2O_3 + 2(Mn_3O_4,CoO) + 4H_2O$, or considering the iron to be present as admixed limonite, $(MnO,CoO) + Mn_2O_3 + 4H_2O$.

	Fe_2O_3.	Mn_3O_4.	CoO.	H_2O.	Total.
I.	20·952	41·873	4·761	32·379	99·964
II.	33·28	24·63	2·05	40·02	99·98

Analysis II is of the pulverulent substance from another point in the district; with this material no purple coloration was obtained with sulphuric acid; formula, $Fe_2O_3 + (Mn_2O_3,CoO) + 4H_2O$, or, eliminating limonite, $(MnO,CoO) + MnO_2 + 4H_2O$. Copper, which was found by Rammelsberg in asbolite from Kamsdorf, Thuringia, is here absent. L. J. S.

Limestones of Sussex Co., New Jersey. By FRANK L. NASON (*Amer. Geol.*, 1894, **13**, 154—164).—Several analyses are given of the white crystalline limestones in which occur the franklinite deposits of Sussex Co., N.J. They usually contain about 40 per cent. of magnesium carbonate, and thus approach true dolomites; when, however, they are in contact with the granite dykes there is only a little magnesium carbonate, but they here contain chondrodite, phlogopite, tremolite, and tourmaline. Farther from the granite, these white crystalline limestones pass into grey dolomitic limestones.

L. J. S.

Limestone from Konĕprus, Bohemia. By FRANZ ŠTOLBA (*Verh. k.k. geol. Reichsanst.*, 1894, 195; from *Böhm. Zeits. chem. Indust.*, 1893, **3**, 336).—Analyses of this Devonian (f_2) limestone show over 99 per cent. $CaCO_3$; it occurs in large masses of uniform quality, and is the purest of Bohemian limestones. L. J. S.

Mineral Waters from Styria. By ANTON FRITZ REIBENSCHUH (*Mitth. Ver. Steiermark*, 1893, **29**, 262—274).—Water from the Semlitsch Spring at Radein gave in 10,000 parts: K_2SO_4, 0·12248; KCl, 0·02516; NaCl, 0·03537; $NaHCO_3$, 0·51914; $CaH_2(CO_3)_2$, 3·42971; $MgH_2(CO_3)_2$, 1·31306; $FeH_2(CO_3)_2$, 0·37031; Al_2O_3, 0·05371; SiO_2, 0·59744; CO_2, 20·65818 = 27·12456, also traces of strontium and lithium; sp. gr. 1·0006 at 14°. Other waters from the same region in S.E. Styria are mentioned. L. J. S.

Water from the Klebelsberg Spring, Ischl. By H. DIETRICH (*Jahrb. k.k. geol. Reichsanst.*, 1893, **43**, 275—280).—This spring was met in the workings of the salt and anhydrite deposits at Ischl in Upper Austria. Analysis gave in 1,000 parts: K_2SO_4, 0·04542; Na_2SO_4, 0·37191; $CaSO_4$, 0·21089; $SrSO_4$, 0·00130; $BaSO_4$, 0·00059; $CaCO_3$, 0·01800; $MgCO_3$, 0·02980; $FeCO_3$, 0·00391; $MgCl_2$, 0·32526; NaCl, 4·53387; LiCl, 0·00694; $Ca_3(PO_4)_2$, 0·00184; Al_2O_3, 0·00335; SiO_2, 0·01250; CO_2 (in bicarbonates) 0·02500; CO_2 (free), 0·04200 = 5·63258. Sp. gr. 1·00526 at 15°. L. J. S.

Mineral Water from Radein, Styria. By ANTON FRITZ REIBENSCHUH (*Mitth. Ver. Steiermark*, 1894, **30**, 358—369).—Water from the Radein "Sauerbrunnen" gave in 10,000 parts:—K_2SO_4, 3·1124; Na_2SO_4, 0·5385; NaCl, 6·2939; $NaHCO_3$, 43·1778; $LiHCO_3$, 0·4973; $CaH_2(CO_3)_2$, 5·7473; $MgH_2(CO_3)_2$, 3·4991; $FeH_2(CO_3)_2$, 0·2386; Al_2O_3, 0·0092; SiO_2, 0·2004; CO_2, 30·6210 = 93·9355; also traces of phosphoric acid and strontium; sp. gr. 1·00564 at 15°.

L. J. S.

Variation in Composition of Mineral Waters at Different Periods. By C. REMIGIUS FRESENIUS (*Jahrb. Nassau. Ver. Naturk.*, 1894, **47**, 13—23).—Analyses of various mineral waters of Nassau made at different periods are compared. Several analyses are quoted of the water of the Niederselters Spring, the earliest being that of Westrumb (1794), and Fresenius' own dating from 1845 to 1863; the maximum and minimum amounts of the constituents per 1,000 parts of water are

	NaCl.	Na_2CO_3.	$CaCO_3$,SiO_2, &c.	Total solids.
Maximum ..	2·3542	0·8739	0·6719	3·8407
Minimum ...	2·0159	0·7903	0·5481	3·3543

The minima all occur in Fresenius' analysis of 1859, and the maxima (except of the Na_2CO_3) in his analysis of 1861. Although there have been slight variations in the concentration and relative amounts of the constituents, the character of the water has remained unchanged for a long period. It is pointed out that after wet seasons the concentration has been greater. In other waters there has been less variation the higher the temperature, this being due to the water being of deep-seated origin, and thus less liable to be affected by surface agencies. Below is given the ratio of the maximum (= 100) and minimum amounts of the total solids in the analyses compared.

	Temperature.	
Niederselters..........	15·5°	100 : 87·3
Kränchen, Ems........	36·0	100 : 95·9
Kesselbrunnen, Ems....	47·0	100 : 98·9
Kochbrunnen, Wiesbaden	68·5	100 : 99·7

L. J. S.

A Salt Lake in the Transvaal. By EMIL COHEN (*Tsch. Min. Mitth.*, 1895, **15**, 1—8, and 194—195).—This small salt lake or pan, situated to the north of Pretoria, lies in a deep funnel-shaped depression in granite; besides rock salt, trona and some calcite occur, but no gypsum, although the latter is abundant in the ordinary salt pans of South Africa, these occurring in shallow depressions in sedimentary rocks. A sample of the water of sp. gr. 1·179, analysed by H. Hopmann, contained 21·14 per cent. of solids, consisting of Na_2CO_3, 27·25; NaCl, 72·70; Na_2SO_4, 0·05 per cent.; also traces of B_2O_3. Various suggestions are made to account for the origin of this pan.

L. J. S.

Physiological Chemistry.

Detection of Argon in the Air Bladder of Fishes and Physalidæ. By TH. SCHLOESING, jun., and JULES RICHARD (*Compt. rend.*, 1896, **122**, 615—617).—An analysis of gas contained in the air bladder of different varieties of fish taken from various depths is given in the following table.

	Polyprion. Cernium V.	Physalia.	Muræna helena L.	Synaphobranchus pinnatus Gr.		
Depth ..	Surface.	Surface.	88 m.	900 m.	1385 m.	
CO_2 ...	2·2	0·0	6·4	3·1	0·0	3·6
O	18·8	12·2	73·1	75·1	78·4	84·6
N	79·0	87·8	20·5	21·8	21·6	11·8

Absorbing the carbonic anhydride and oxygen, and finally the nitrogen, by sparking over potash, the amount of the residual argon was found to be as follows.

	Physalia.	Muræna.	Synaphobranchus.
Argon	1·18 p. c.	1·85 p. c.	1·94 p. c.

J. F. T.

Nutrition of Frog's Heart. By Arthur H. White (*J. Physiol.*, 1896, **19**, 344—355).—Serum albumin is regarded as the only proper nutrient for the frog's heart. If the heart is removed from the body and fed by the usual perfusion apparatus, with a saline solution, a stage is at last reached when all the blood is washed out from its interstices; and then no stimulus, or no amount of feeding, will cause it to contract, that is to say, it cannot contract at the expense of its own substance. It is only when it is in this condition that the test can be applied as to what is really a nutrient fluid. The true nutrients, that is, those capable of restoring the heart, are those which, like blood, serum, and lymph, contain both the serum proteïds and salts.

W. D. H.

A New Hæmoglobinometer. By George Oliver (*Proc. physiol. Soc.*, 1896, 15—16).—The blood is suitably diluted and placed in a shallow blood cell, where it rests on a white background made of precipitated calcium sulphate.

It is then compared with standard gradations arranged as a number of circular discs on a slab. The colours of these have been in all cases matched by Lovibond's colour-standard glasses. A separate set of standards is required for candlelight.

Observations of the blood cell and the standards are made through a camera.

W. D. H.

Estimation of the Number of Blood Corpuscles. By George Oliver (*Proc. physiol. Soc.*, 1896, 16).—When the long diameter of a flattened tube filled with water is directed towards a candle flame, a transverse line of light is seen, made up of closely packed, minute images of the flame produced by the longitudinal fibrillation of the glass. When a measure of blood (10 cubic mm.) is washed into such a tube by Hayem's or other fixing fluid, the illuminated line is shut out of view, until, at a certain degree of dilution, it can just be detected as a faint streak. The amount of dilution is a delicate indicator of the percentage of corpuscles, and the tube can be graduated by comparison with an apparatus for counting the corpuscles.

W. D. H.

Coagulation of Blood. By R. M. Horne (*J. Physiol.*, 1896, **19**, 356—371).—The soluble salts of calcium, strontium, and barium retard or prevent the coagulation of the blood when present in the proportion of 0·5 per cent. and upwards. Barium salts are the most powerful in this direction (0·25 per cent. of barium chloride is sufficient), calcium the least.

Calcium hydroxide in saturated aqueous solution does not retard, strontium only slightly retards, whilst barium hydroxide is highly effective in retarding blood coagulation. This influence is overcome in all cases by dilution with distilled water, or by the addition of a suitable amount of potassium oxalate. Coagulation delayed in the way described is accelerated by a temperature of 30—40°.

The chlorides of sodium and potassium, added to the extent of 0·07 per cent. and upwards, still further retard the coagulation of such mixtures. W. D. H.

Absorption of Fluids from Connective Tissue Spaces. By Ernest H. Starling (*J. Physiol.*, 1896, **19**, 312—326).—Salt solutions isotonic with the blood plasma can be, and are, absorbed directly from the blood vessels. This statement probably holds good for dropsical fluids containing small percentages of proteïd. A backward filtration into the vessels is mechanically impossible in the connective tissue of the limbs, of the muscles, and of glands (similar in structure to the submaxillary).

The proteïds of serum have an osmotic pressure equal to 30—40 mm. of mercury. Absorption of isotonic salt solutions by the blood vessels is determined by this osmotic pressure of the serum proteïds. The same factor is probably responsible for the absorption from the tissues which ensues on any general lowering of capillary pressures, such as artificial anæmia. The proteïds of the tissue fluids, when not used up in the tissues themselves, are probably absorbed mainly, if not exclusively, by the lymphatic system.

If the term "molecular imbibition" of Hamburger is replaced by osmotic pressure of the proteïds of the tissues and the blood, the explanation of absorption given above is practically identical with that proposed by this observer. W. D. H.

Extirpation of Salivary Glands. By Edward A. Schäfer and B. Moore (*Proc. physiol. Soc.*, 1896, 13—14).—From the result of an experiment on a dog, the conclusion is drawn that the salivary glands do not exert any great metabolic influence apart from their external secretion, as does the pancreas. W. D. H.

Iron in the Liver and Spleen. By Ralph Stockman (*Brit. Med. J.*, 1896, i, 1077—1079).—The liver contains a store of iron, combined with nucleo-proteïd in various degrees of intimacy. This is a reserve store which is called on after hæmorrhage, or when the dietary is poor in iron. An average dietary contains 6 to 11 milligrams of iron, which just about balances the daily loss. The normal liver contains in the mean 0·08 gram of iron per 100 grams of the dried organ, this number being derived from analyses detailed in the present research, together with those made by other observers. In general terms, the same is true for the spleen, only as it is impossible to obtain this organ free from blood, it is difficult to estimate the amount of iron in the blood-free organ; it is, however, less than in the liver.

A number of analyses are given of livers and spleens from cases of disease associated with different forms of anæmia; in most, the amount of iron is considerably diminished, although the organs are never entirely free from the element. The most striking exception to this is seen in cases of pernicious anæmia where the iron is in excess.

It is held that pernicious anæmia is not a disease *sui generis*, but a manifestation seen in many fatal conditions associated with intense anæmia. These conditions are, moreover, associated with the occurrence of capillary hæmorrhages in many organs; and it is to these, and not to a special form of blood destruction, that the excess of iron in the organs is due. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Behaviour of the Leguminous Nodule Bacteria towards Caustic Lime. By BRUNO TACKE, and others (*Mitt. Ver. Förd. Moorkultur*, 1895, **13**, 389—399).—In consequence of the failure of soil inoculation on land to which lime had been applied, as compared with the results obtained with marl (Salfeld, this vol., ii, 332), it was decided to investigate the action of lime on nodule bacteria by means of pot experiments. Two soils were selected, (1) a sandy soil, and (2) a peaty soil, of the following composition (per cent. in dry matter).

	Loss on ignition.	Nitrogen.	Ash.	K_2O.	CaO.	MgO.	Fe_2O_3. Al_2O_3.	P_2O_5.	SO_3.
1.	4·43	0·16	95·57	0·05	0·03	0·02	0·82	0·07	0·04
2.	89·73	1·42	10·27	0·07	0·23	0·20	0·97	0·13	0·31

The soils received mineral manures, with lime, 15 or 20 grams, corresponding with about 24 or 32 cwt. per acre, and with marl respectively; and suitable soil was added for inoculating for peas, which were the plants to be grown. Some pots were left without inoculation. The results were as follows: sandy soil Nos. 1—4, peaty soil Nos. 5—10.

	Dry produce (grams).			Nitrogen, per cent.		Total nitrogen (grams).
	Corn.	Straw.	Total.	Corn.	Straw.	
1. Not inoculated; no lime	9·62	22·12	31·74	3·79	2·40	0·895
2. ,, ,, limed.	12·83	22·01	34·84	3·57	2·03	0·905
3. Inoculated; no lime ...	12·16	24·79	36·95	3·58	2·44	1·039
4. ,, limed.....	18·59	28·08	46·67	3·64	1·83	1·190
5. Not inoculated; no lime	1·31	3·04	4·35	3·56	1·64	0·097
6. ,, ,, limed.	61·86	67·09	128·95	4·16	1·29	3·439
7. Inoculated; no lime ...	3·44	6·63	10·07	3·45	1·39	0·211
8. ,, limed	66·61	83·60	150·21	4·12	1·20	3·744
9. Not inoculated; marled	68·26	82·24	150·50	4·25	1·21	3·900
10. Inoculated; marled....	68·63	90·34	158·97	4·05	1·18	3·845

The roots of the plants of pots 1, 2, 5 had no nodules; those of pots 3 and 7 had very few, whilst in pot 7 there were three agglomerations on one root. On the roots of all the other plants, nodules were more or less abundant.

As regards the experiments in sandy soil, the results show that lime, in the large quantity applied, not only does not injure the nodule bacteria, but considerably assists their development. This is perhaps due, in part, to the strengthening of the plant by the presence of lime during the period in which the bacteria enter the roots. The results obtained with peaty soil clearly indicate the necessity of an application of lime in some form to such soils. The position of the nodules in the pots 6 and 9 indicated accidental inoculation. As in sandy soil, the application of lime did not injure the nodule bacteria.

After the plants were cut, more mineral manure was applied (pots 1 to 4), and pots 2 and 4 received a further application of lime (30 grams each), corresponding with about 48 cwt. per acre, or three times as much as in Salfeld's field experiments (*loc. cit.*), and the quantity of water given was reduced, so as to amount to 10 per cent. of the dry soil. Early in August, field peas were sown. In pots 1 and 3, the plants died, and were re-sown. The following amounts of dry produce and nitrogen were obtained (in grams), including two crops for pots 1 and 3.

Dry produce.				Nitrogen.			
Pot 1.	Pot 2.	Pot 3.	Pot 4.	Pot 1.	Pot 2.	Pot 3.	Pot 4.
7·24	6·05	5·26	15·76	0·299	0·232	0·205	0·573

The results show that even in very dry soil there was no injury to the nodule bacteria by the large application of lime.

The results obtained in the field (*loc. cit.*) still remain, therefore, unexplained. Further experiments are in progress.

N. H. J. M.

Nitrogen Assimilation of some Papilionaceæ. By JOHANN BILLWILLER (*Inaug. Diss., Bern.*, 1895, 50 pp.).—In the first series of experiments described, lupins, vetches, and peas were grown in sand nearly free from nitrogen, (1) with no nitrogen added, (2) with nitrate, (3, 4, 5, and 6) inoculated from pea nodules, from vetch nodules, from lupin nodules, and with garden soil extract respectively. There were also pots with oats and with buckwheat, with and without nitrate. The necessary ash constituents were supplied in each case. Whilst the oats and buckwheat failed in absence of nitrate, the papilionaceous plants all developed and grew well both with and without nitrate, and also in the pots which had not been inoculated, owing to the sand not having been sterilised. The peas which received nitrate contained 4·223 per cent. of nitrogen, the others 4·318 per cent.

In the second series, there were three pots, each with two peas and one vetch; the first had nitrate, the second and third no nitrate, but the second was subsequently inoculated with a single pea nodule. The sand of all three pots had been sterilised. At the end of the experiment, it was found that the nitrate pot had become accidentally infected, the plants having nodules on the roots. The following amounts of produce were obtained (grams).

Nitrate; inoculated.		No nitrate; inoculated.		No nitrate; sterilised.	
Peas.	Vetches.	Peas.	Vetches.	Peas.	Vetches.
16·35	10·12	13·5	7·5	1·94	0·65

The third series was similar to the second, and included peas, vetches, and beans, special precautions being taken to avoid accidental infection. Each set comprised several pots; the average results (in grams) were as follows.

	Peas.	Vetches.	Beans.
Inoculated; without nitrate[*]	10·11	6·7	3·68
Sterilised; with nitrate......	6·18	2·93	2·98
„ without nitrate...	4·09	1·33	failed

The sterilised plants had roots much more branched and more fibrous than the inoculated plants. Nodule formation was greatest in positions were air had access, as, for instance, near the openings at the bottom of the pots; this is in accordance with the fact that the papilionaceæ grow chiefly on light soils.

Experiments were made in which the same plants (peas, vetches, and beans) were grown in pots filled with rich soil, with and without the addition of calcium carbonate (20 per cent.). The following average amounts of produce were obtained (in grams).

	Peas.	Vetches.	Beans.
With calcium carbonate	20·96	8·85	25·68
Without calcium carbonate..	11·52	7·98	22·50

The peas were thus specially benefited by the application of calcium carbonate. N. H. J. M.

Effect of Chemical Agents on Germination. By WILHELM SIGMUND (*Landw. Versuchs-Stat.*, 1896, **47**, 1—58).—Seeds of wheat, rye, barley, peas, and rape were kept for 24 hours in various solutions, and then left to germinate between moist filter paper. In the case of insoluble, or sparingly soluble, substances, the seeds were placed on a layer of the substance on moist filter paper. The effect of the vapour of volatile liquids was also studied. The exact conditions of temperature, &c., are recorded.

The chemical agents employed were—elements (iodine, sulphur, carbon, zinc, iron, and antimony), oxides, peroxides, acids, bases, salts, hydrocarbons, halogen derivatives, alcohols and ethers, &c.; nitrogen compounds including hydrogen cyanide, potassium ferro-, and ferricyanides, urea; organic acids and salts, tannin, fats, and ethereal oils, pyridine, alkaloïds, substances resembling alkaloïds physiologically (sulphonal, tertiary amylic alcohol, paraldehyde, antipyrine, &c.); antiseptics, and coal-tar dyes. There were 17 series, comprising 275 experiments, including about 200 different substances.

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[*] In summarising these results, it is stated that the greatest production of organic substance was obtained, in each case, under the influence of *inoculation and with nitrogen;* next without inoculation, but with nitrate; and lastly, without inoculation and without nitrogen. The plan of the experiments, however, as previously stated, was to grow the plants (1), inoculated, but without nitrogen; (2), not inoculated, but with nitrate; and (3), not inoculated, and without nitrate; and the headings of the three tables of results, from which these numbers are taken, are in accordance with this plan.—N. H. J. M.

The results show that, as regards acids, both mineral and organic acids are injurious, and that strongly acid salts (such as hydrogen potassium sulphate) are more injurious to germination than the corresponding neutral salts. The different kinds of grain, however, resist, to some extent, the action of acids.

Free bases and strongly basic salts are poisonous. The neutral salts of the alkalis and alkaline earths are without effect, in the case of peas and rape (and probably all *Leguminosæ* and *Cruciferæ*) when the strength does not exceed 0·5 per cent., and sometimes even beneficial up to 0·3 per cent. All other salts are injurious, and generally, when much less concentrated.

Fats and ethereal oils prevent the germination of corn, and very much retard peas and rape.

Anæsthetics and hydrocarbons generally retard germination, whilst their vapours kill the seeds. Peas are the most resistant.

Alkaloïds and similar (physiologically) substances (0·1 per cent.) retard germination more or less. Grain, however, generally developed normally, whilst peas were the most sensitive. Greater concentration is injurious. The organic antiseptics are all injurious in solutions of more than 0·1 per cent.

Coal-tar dyes are poisonous in 0·05 per cent. solutions. (Compare Jarius, Abstr., 1886, 90; Tautphöns, *Bied. Centr.*, **9**, 351; Nessler, *ibid.*, **12**, 125; Bruttini, *Staz. Sper. Agron.*, 1894, 27 and 30; Mosso, this vol., ii, 326; Haselhoff, Abstr., 1894, ii, 208; 1896, ii, 267; König and Haselhoff, *ibid.*, 1896, ii, 210). N. H. J. M.

Effect of some Substances used as Manures on Germination. By Claudel and J. Crochetelle (*Ann. Agron.*, 1896, **22**, 131—142).—Incrustation of seeds is often practised solely to facilitate their dissemination, although it is frequently asserted that when lime or nutritive substances are employed, the effect on germination is the same as steeping. A number of experiments were made with the view of ascertaining whether certain salts, in small quantities, hinder germination, or are beneficial. In the first series of experiments, now described, the seeds were placed in sand contained in flat dishes, and watered with equal amounts of pure water, and of dilute solutions of the various salts. The seeds selected were sanfoin, lupin, vetch, horse-bean, pea, lentil, lucerne, colza, mustard, flax, and wheat. The manurial substances were: potassium sulphate and chloride, ammonium sulphate, ammonium, potassium, magnesium, and iron phosphates, phosphoric acid, basic slag, lime, chalk, and sodium nitrate. The soluble compounds were used in solutions of various strength (0·05, 0·1, 0·2, and 0·5 per cent.), the insoluble compounds mixed with the sand. The results, which are fully given in tables, showing the numbers of seeds which germinated under the different conditions, show that the potassium salts, ammonium sulphate, sodium nitrate, and superphosphate, in the quantities applied were injurious to germination, but not on all the seeds equally; wheat being best able to resist their action, lentils, lucerne, and flax being specially sensitive Lime water and basic phosphates are very favourable to germination, especially in the case of leguminous seeds.

The results of experiments on germination in 0·05, 0·1, 0·2, and 0·5 per cent. sulphuric acid, showed that in the most dilute of the solutions, clover and beet only partially germinate, colza not at all, whilst vetches, wheat, barley, and oats germinate as in water. In 0·1 per cent. acid, oats alone germinated completely (although late); of barley, only 40 per cent. germinated, and of vetches one-third. Wheat, beet, clover, and colza did not germinate. In the stronger solutions (0·2 and 0·5 per cent.), none of the seeds germinated.

The amount of acid produced during the germination of different seeds was next determined. The results are expressed as sulphuric acid per cent. on the weight taken.

Wheat (8 days)........	0·387	Lentil...............	0·304
„ (well germinated)	0·558	Vetch...............	0·273
Oats (8 days)	0·186	Pea...	0·207
Barley	0·285	White lupin	0·465
Rye..................	0·300	Flax	0·108
Colza	0·443	Hemp	0·124
Beet	0·325	Rape...............	0·713
Clover	1·612	Mustard...........	0·452
Horse-beans	0·139	Spurrey............	0·279

The amount of acid produced is thus very great, and it is thought that the favourable effect of lime, &c., is due to the neutralisation of the acids, and also to the prevention of loss of phosphoric acid or acid phosphates liberated during germination, by forming insoluble phosphates. To the same cause may also be attributed the benefit to acid soils by liming.

It is concluded that an appropriate treatment of seeds is immersion in dilute liquid manure or incrustation with lime.

N. H. J. M.

Formation and Behaviour of the Pentoses in Plants and Animals. By K. GOETZE and THEODOR PFEIFFER (*Landw. Versuchs-Stat.*, 1896, **47**, 59—93).—Pentoses are formed in plants from the commencement of their growth, and can be utilised as a reserve substance (like the true carbohydrates) if assimilation is stopped by exclusion of light. The production of pentoses is coincident with that of cellulose, and whether this production has any direct influence on lignification or not, it is noteworthy that it probably always accompanies it.

The *Gramineæ* seem to be particularly rich in pentoses, whilst the *Leguminosæ* contain much less.

Pentoses are partly resorbed and partly rejected by animals. In experiments with sheep, no determinable amount of pentoses was found in the urine, but the greater production of hippuric acid, after the consumption of easily digested pentoses, indicates that some relation exists between the two, and throws light on the results of

Henneberg's metabolism experiments, and on Meissner and Shepard's investigations on the production of hippuric acid in the animal organism. N. H. J. M.

Combustibility of Tobacco. By ALEXANDER CSERHÁTI (*J. Landw.*, 1895, **43**, 379—458).—Nessler's statement that tobacco containing over 0·4 per cent. of chlorine with less than 2·5 per cent. of potash will not burn well, and the view that the combustibility of tobacco depends mainly on the amounts of chlorine and potash it contains, are erroneous. The combustibility varies with the position of the leaves on the stem, the central leaves generally, but not always, burning best. Different varieties of tobacco vary considerably in combustibility, even when grown under exactly the same conditions. The Hungarian varieties mostly burn feebly, owing partly to the soils and partly to the climate; moisture and warmth are favourable to combustibility, which is diminished by a dry climate. As regards soil, the physical properties are of considerable importance. The application of dung in the spring is not always so injurious to combustibility, as is frequently stated. As regards nitrogenous manuring, ammonium sulphate is injurious, whilst sodium nitrate is not. Phosphatic manures are not usually injurious, and sometimes increase the combustibility. Potash is not at all as beneficial as is generally supposed; it has, as a rule, no effect in the case of clay soils. Liming is extremely advantageous in increasing the combustibility of tobacco when the soil is poor in lime (compare Patterson, this vol., ii, 211). N. H. J. M.

Reduction of Nitrates in Arable Soil. By EMILE BRÉAL (*Ann. Agron.*, 1896, **22**, 32—37).—In comparing the effects of sodium nitrate with lucerne (as green manure), bullock's urine, and cow dung (all containing equal amounts of nitrogen), Wagner (*Journ. Agric. Prat.*, 1895, 26 Aug.) found that the most nitrogenous crops were obtained with the nitrate. The nitrogen of the lucerne and of the urine were well utilised when used alone, but when the urine and dung were employed together there was a great loss of nitrogen, which was attributed to denitrification by ferments. In 1892, the author showed the presence of denitrifying ferments in certain vegetable substances, notably in wheat straw (Abstr., 1892, 1259), and evidence is now given showing the effect of denitrification in soils.

Two lots of 200 grams of good soil were watered each with 100 c.c. of well water, and with the same water containing denitrifying organisms from straw. On extracting the soils with equal amounts of water, the following amounts of nitric nitrogen were found: with denitrifying water 0·008, with pure water 0·143 gram. These amounts calculated per hectare represent 4 kilos. and 71·5 kilos. respectively (or about 3·5 and 64 lbs. per acre). When, however, straw is incorporated with the soil, nitrification may be greatly increased, and denitrification more or less checked (compare Deherain and Pagnoul, this vol., ii, 329), owing to the loosening of the soil and the consequent aëration.

The effect of consolidation in inducing denitrification was shown by filling a glass tube, 0·4 metre long, with rich garden soil undergoing vigorous nitrification. After consolidating the soil by tapping the tube, 150 c.c. of water was continually passed through the soil and back again for three weeks. The amount of nitrates in the water rapidly diminished, and at the end of the experiment diphenylamine sulphate no longer gave a coloration.

N. H. J. M.

Causes of Loss of Nitrogen in Decaying Organic Matter, especially Farmyard and Liquid Manure. By R. BURRI, E. HERFELDT, and ALBERT STUTZER (*J. Landw.*, 1895, **43**, 1—11).—Experiments were made with the object of ascertaining how to avoid loss of ammonia in manure by hindering volatilisation of ammonia and by controlling the action of the bacteria which produce ammonia. A nutritive solution was employed containing peptone (1·0), urea (1·0), potassium phosphate (0·1), sodium chloride (0·1), magnesium sulphate (0·05 per cent.), and traces of calcium chloride. In the different experiments, this solution was mixed with an equal volume of water and weighed quantities of the substances to be examined, namely gypsum, superphosphate gypsum, kainite, and dicalcium phosphate; free phosphoric acid was added in a diluted condition. The experiments were made in wide test-tubes with 20 c.c. of liquid, infected with two drops of liquid manure, and kept at 30°. From these infected "original cultivations" small quantities were taken out (after 1 or 24 hours), and added to fresh nutritive solutions without preservatives. In this manner it could be seen whether the bacteria of the original cultivation had been destroyed. Corallin-paper was used to detect ammonium carbonate.

The following conclusions are drawn from the results of the experiments. Gypsum (2·5 to 10 per cent.) is quite useless as a preservative; it neither fixed already formed ammonia nor sufficiently hindered the production of ammonia even when employed in large quantities. Kainite (2·5 to 10 per cent.) hindered ammonia production considerably, but is not an absolutely safe means of preventing loss. Dicalcium phosphate (2·5 to 10 per cent.) is quite useless. Superphosphate gypsum (0·4 to 1 per cent. soluble P_2O_5) and free phosphoric acid (0·4 to 1 per cent.) are both very effective. It is not thought that phosphoric acid has itself any specific action on the ammonic bacteria, but that its action is due to its acid reaction. In one hour, the phosphoric acid killed the bacteria, but did not destroy the spores; in 24 hours, the sporés were also destroyed when more than 0·4 per cent. of the acid was added (compare Immendorff, Abstr., 1894, ii, 210). N. H. J. M.

Manurial Effects of Magnesium Compounds and of Iron Sulphate. By A. LARBALÉTRIER and L. MALPEAUX (*Ann. Agron.*, 1896, **22**, 20—32).—The alleged injurious effect of magnesia on plants seems to be only correct in the case of the chloride, other salts probably being without injury if lime and other fertilising constituents are present in the soil (compare Loew, Abstr., 1895, ii, 206).

A number of experiments are described in which different plants were grown in sandy soil to which magnesium carbonate and sulphate (each 268 lbs. per acre) and iron sulphate (134 lbs. per acre) respectively were applied, and there was in each case a fourth plot to which nothing had been added. In the case of barley, there was a slight increase of grain and straw under the influence of the magnesium salts (especially the sulphate), but the chief effect was on the weight of the grain, which was, unmanured 46 kilos. per hectolitre, manured with magnesium carbonate and sulphate 49·5 and 50 kilos. respectively. With regard to potatoes, the magnesium sulphate considerably increased the percentage of starch. No very definite conclusions can, however, be drawn from this first series of experiments. It is probable that an application of magnesia to soils containing 0·021 per cent. of magnesia is unnecessary. The sulphate seems to be more active than the carbonate; moreover, the carbonate is somewhat costly, and, owing to its lightness, liable to be lost by winds. It is possible that the application of magnesia along with other salts might be beneficial and remunerative. Further experiments are required. N. H. J. M.

Effect of Different Amounts of Lime and Magnesia on the Development of Pine Trees. By Oscar Loew and Seiroku Honda (*Bull. Coll. Agric., Imp. Univ., Tokyo*, 1896, **2**, 378—386).—Whilst calcareous soils are valued for agriculture and forestry, especially for pines, magnesia may be injurious if present in quantity in excess of that of the lime (Wolff, *Landw. Versuchs-Stat.*, **6**, 218; Raumer and Kellerman, *ibid.*, **25**, 31; and Loew, *ibid.*, **41**, 469), although to a much less extent when in the form of the sparingly soluble carbonate.

A number of experiments were made in which young plants of *Cryptomeria japonica*, *Thuja obtusa*, and *Pinus densiflora* were planted in pots containing sand (5 kilos.) which had been thoroughly extracted with strong hydrochloric acid. The plants were watered with a solution containing K_2HPO_4 (1·0), KCl (1·0), $(NH_4)_2SO_4$ (2·0), and $FeSO_4$ (0·1 per cent.), and with varying amounts of (*a*) 1 per cent. calcium nitrate and (*b*) 1 per cent. magnesium sulphate solutions, thus: pots 1 to 4 (A) 50, 45, 25, and 10 c.c. of solution (*a*); pots 2 to 5 (B) 5, 25, 40, and 50 c.c. of solution (*b*) respectively. The results are given in detail in tables showing the height of the plants after the first and second years, number of branches, total weight, &c., and there are also photographs of the plants of the two series.

The results point to the conclusion that a calcareous soil is favourable to the growth of pines when the amount of magnesia is relatively very small, but becomes less favourable when the magnesia is in excess of the lime. The effect of deficiency of lime is most conspicuous in producing short needles. N. H. J. M.

Analytical Chemistry.

Volumetric Analysis of a Mixture of Chlorides, Hypochlorites, and Chlorates. By ADOLPHE CARNOT (*Compt. rend.*, 1896, **122**, 449—452).—The hypochlorite is first estimated by means of a standard arsenite solution. The liquid is then acidified, mixed with ferrous ammonium sulphate equal to at least 20 times the weight of the chlorate supposed to be present, boiled out of contact with air, and gradually mixed with 5 c.c. of sulphuric acid diluted with 15 c.c. of water. The excess of ferrous salt is determined with permanganate solution, and the amount of chlorate is thus ascertained. An aliquot part of the liquid is mixed with a few drops of ferrous sulphate to remove excess of permanganate, an excess of a standard solution of silver nitrate is then added, and the silver remaining in solution is estimated by thiocyanate solution. The total chlorine is thus determined. C. H. B.

Analysis of a Mixture of Chlorides, Chlorates, and Perchlorates. By ADOLPHE CARNOT (*Compt. rend.*, 1896, **122**, 452—454).—The chloride may first be estimated by means of silver nitrate and thiocyanate solutions; the chlorate is then reduced by means of ferrous sulphate (preceding abstract), and the chlorine again determined in the same way. The ferrous sulphate does not reduce perchlorates.

Another plan is to estimate the chloride directly with silver nitrate solution, using an alkali arsenate as indicator, and then estimate the chlorate by means of ferrous sulphate (*loc. cit.*).

In order to estimate the perchlorate without loss by volatilisation, the solid substance is mixed with four or five times its weight of well washed and dry quartz sand. This mixture is placed in a platinum crucible and covered with a layer of the sand to a depth of 1 to 2 cm.; the crucible is then heated for 20 or 30 minutes with a Bunsen flame in such a way that only the bottom of the crucible becomes red hot. No chlorine is lost, and the total chlorine in the residue is estimated by means of silver nitrate solution.

C. H. B.

Detection of Fluorine in Beer. By J. BRAND (*Chem. Centr.*, 1895, ii, 906; from *Zeit. ges. Brauw.*, **18**, 317—319).—One hundred c.c. of the sample is rendered alkaline with ammonium carbonate, heated to boiling and precipitated with 2—3 c.c. of a 10 per cent. solution of calcium chloride. The precipitate is collected on a filter, slightly washed, and calcined in a 25 c.c. platinum crucible, 1 c.c. of sulphuric acid is added, and hydrogen fluoride tested for in the well-known way by its action on glass. The heating is continued for an hour, the top of the watch-glass being cooled with ice. The presence of 0·01 gram of ammonium fluoride in a litre of beer may thus be detected. L. DE K.

New Process for estimating Sulphur in Organic Compounds. By ALEXANDER VON ASBÓTH (*Chem. Zeit.*, 1895, **19**, 2040).—The author's process may be used when the substance is not too volatile. One gram of the powdered sample is mixed in a nickel crucible with 10 grams of dry sodium carbonate and 5 grams of sodium peroxide, and then very gradually heated to complete fusion. The mass, after cooling, is dissolved in water, and the solution is filtered; and after acidifying with hydrochloric acid containing bromine, and boiling, the sulphuric acid is precipitated with barium chloride.

The process is also suitable for liquids or extracts; these are first evaporated with 5 grams of sodium carbonate, another 5 grams of the latter and 5 grams of the peroxide is then added, and the mixture is fused. L. DE K.

Estimation of Citrate Soluble Phosphoric acid in Basic Slags. By PAUL WAGNER (*Chem. Zeit.*, 1895, **19**, 1419—1421).—Five grams of the finely powdered sample is introduced into a special half-litre flask which is filled up to the mark with solution of ammonium citrate; the flask is then fixed in a rotating apparatus turning round its axis 30—40 times per minute. The citrate solution is made by dissolving 150 grams of pure citric acid in water, adding a quantity of ammonia containing exactly 27·93 grams of NH_3, and then making up to 1 litre; before use, two volumes of this liquid is diluted with three volumes of water.

After the shaking, the liquid is filtered, and 50 c.c. is mixed with solution of ammonium molybdate, and heated for 10—15 minutes in a water bath at 80—95°. The molybdate is best prepared by dissolving 125 grams of the acid in 100 c.c. of water and 300 c.c. of 8 per cent. ammonia; after adding 400 grams of ammonium nitrate, the mixture is made up to a litre, poured into a litre of nitric acid of 1·19 sp. gr., kept at 35° for 24 hours, and then filtered. The yellow phosphate precipitate is first washed with water containing 1 per cent. of nitric acid, and then dissolved in 100 c.c. of cold 2 per cent. ammonia; 15 c.c. of magnesia mixture is now slowly added, and, after two hours, the precipitate is collected, washed with ammonia of 2 per cent. strength, and then treated as usual.

The author prepares the magnesia mixture by dissolving 110 grams of crystallised magnesium chloride and 140 grams of ammonium chloride in 700 c.c. of 8 per cent. ammonia and 1300 c.c. of water. L. DE K.

Estimation of Arsenic. By RODOLPHE ENGEL and J. BERNARD (*Compt. rend.*, 1896, **122**, 390—392).—Oxygen compounds of arsenic are completely reduced by hypophosphorous acid in presence of concentrated hydrochloric acid, and the reduced arsenic is attacked by iodine with formation of arsenious acid in acid solutions, and arsenic acid in presence of alkalis. The arsenic solution is concentrated to 20—40 c.c., mixed with three times its volume of hydrochloric acid of 22° B., and a large excess of hypophosphorous acid. After remaining for about 12 hours in a well closed vessel, the liquid is heated gently on a water bath, mixed with an equal volume of boiled and still boiling water, filtered, and the precipitate well washed with boiling water. The precipitate is then gradually mixed with a decinormal solution of iodine until the liquid is no longer decolorised after waiting for 2 or 3 minutes; 50 c.c. of water and 10 c.c. of a saturated solution of sodium hydrogen carbonate are then added, and the titration is completed, using starch as indicator; 1 c.c. of the decinormal iodine solution represents 0·0015 gram of arsenic.

The analyses quoted in the paper indicate that the method gives good results in presence of nickel, cobalt, manganese, aluminium, and zinc. C. H. B.

Estimation of Arsenic. By E. J. ARMAND GAUTIER (*Compt. rend.*, 1896, **122**, 426—427).—The author points out that the method of weighing the ring of metal deposited in Marsh's method is especially applicable to the detection and estimation of very small quantities of arsenic or antimony, and that the results are accurate even with so little as 2 milligrams of arsenic. C. H. B.

Volumetric Estimation of Boric acid. By GUNNER JÖRGENSEN (*Chem. Centr.*, 1895, ii, 803; from *Nordisk. pharm. Tidskr.*).—To estimate boric acid in articles of food, milk for instance, 100 c.c. of the sample is mixed with a little sodium carbonate, evaporated to dryness, incinerated, and the ash dissolved in dilute nitric acid; the liquid is then filtered and heated to expel carbonic anhydride. Aqueous soda is now added until the liquid is neutral to phenolphthaleïn; some glycerol is next added, and the boric acid titrated with normal soda; 62 grams of boric acid require for neutralisation 1014 c.c. of normal alkali. L. DE K.

Estimation of Carbon in Iron. By PEIPERS (*Chem. Centr.*, 1895, ii, 803; from *Österr. Zeit. Berg-Hütt*, **34**, 477—478).—For the estimation there are required two unglazed porcelain slabs, a beaker containing a 12·5 per cent. solution of ammonium cupric chloride, and six standard samples of steel containing from 0·2—1·2 per cent. of carbon. Streaks are made on the porcelain slabs with the sample and with the standard samples, and they are then immersed in the copper solution for a few minutes. The iron dissolves, and only leaves the carbon marks, which are then compared as to their intensity.

L. DE K.

A new Apparatus for estimating Carbon. By F. WÜST (*Chem. Centr.*, 1895, i, 1189; from *Stahl u. Eisen*, 15/4, 389—390) —A very elaborate apparatus is used, which, however, will reduce errors to a minimum. The oxidation of the carbon is effected by boiling with sulphuric and chromic acids, and the undue evaporation of sulphuric acid is prevented by introducing into the evolution flask a cooling arrangement. The gas passes through a specially constructed U-tube filled with glass beads moistened with sulphuric acid and then through a combustion tube filled with copper oxide, and heated to redness; to prevent burning of the rubber joints, the ends of the tube are kept cold by a special water-flow arrangement. The carbonic anhydride is again dried by means of glacial phosphoric acid, and then absorbed in two weighed soda-lime tubes containing also some glacial phosphoric acid; a sulphuric acid guard tube is provided, and also an arrangement for drawing purified air through the apparatus.

L. DE K.

Separation of Calcium from Strontium and Barium. By J. DUPASQUIER (*Bull. Soc. Chim.*, 1895, [3], **13**, 678—681).—Calcium in the form of a soluble salt, or as the sulphate, is completely transformed into the tartrate on treatment with a solution of an alkali hydrogen tartrate containing a soluble sulphate. The soluble salts of barium and strontium are, however, under the same conditions converted into insoluble sulphates. The separation is, therefore, easy, the calcium tartrate being readily soluble in dilute mineral acids.

When both calcium, barium, and strontium are present, a measured quantity of the hydrogen tartrate and sulphate solution is added (the quantity of sulphate present being known); the calcium is then separated as above, and the relative proportions of strontium and barium deduced from the weights of the combined sulphates and the quantity of unchanged sulphate in the filtrate. J. F. T.

Estimation of Zinc in Dried Apples. By LUDWIG LEGLER (*Chem. Zeit.*, 1895, **19**, 1763).—Fifty grams of the sample, dried in a porcelain basin, is completely charred, and the residue powdered and boiled with hydrochloric acid; after diluting and filtering, excess of ammonia is added and the liquid diluted to a convenient bulk. An aliquot part of the clear solution is then acidified with acetic acid, and any zinc is precipitated with hydrogen sulphide. If, to save time, the charred portion is not filtered off before adding the ammonia, a slight correction for volume must be made. The author finds that it generally occupies 3 c.c. L. DE K.

Estimation of Copper by precipitating with Sodium Thiosulphate and heating to Oxide. By H. NISSENSON and B. NEUMANN (*Chem. Zeit.*, 1895, **19**, 1591—1592).—The authors have found that the cuprous sulphide obtained by boiling a hydrochloric acid solution of a copper salt with sodium thiosulphate is readily and completely converted into oxide by ignition in a muffle, and recommend this process for the commercial assay of copper ores and compounds.

Arsenic comes down to some extent, but is completely expelled on ignition. Cadmium does not interfere. Large quantities of tin, antimony, lead, &c., must first be removed by the usual methods.

L. DE K.

The Iodide Assay for Copper. By LOW (*Chem. Centr.*, 1895, ii, 64; from *Eng. Min. J.*, 1895, 9/2).—The ore is dissolved in nitric acid, boiled with hydrochloric acid, and evaporated with sulphuric acid; the residue is then dissolved in water and filtered from any lead sulphate. The copper in the filtrate is precipitated by boiling with a sheet of aluminium, washed by decantation, and dissolved in a few c.c. of nitric acid; after fully oxidising any arsenic by means of a little potassium chlorate, the liquid is boiled, mixed with excess of ammonia, then strongly acidified with acetic acid, and the copper titrated, as usual, with potassium iodide and sodium thiosulphate.

The latter solution is standardised by means of metallic copper, also in acetic acid solution. L. DE K.

Estimation of Alum in Wines. By GEORGES (*Bull. Soc. Chim.*, 1895, [3], **13**, 692—696).—This method depends on (1) the properties of aluminium gallotannate, (2) the fact that natural red wines and those which have been adulterated with alum behave differently on the addition of ammonium acetate or of neutral sodium acetate in the presence of a small quantity of tannin (from nut galls).

Alluminium gallotannate is precipitated from a solution of tannin by means of aluminium acetate in the form of a white, voluminous precipitate. It is readily soluble in strong acids; dilute acetic acid is without action on it; decinormal solutions of potassium or sodium hydroxides dissolve it readily in the cold.

The necessary solutions for the estimation are (1) a solution of tannin containing 3·40 grams in 100 c.c. of water, (2) a solution of crystalline neutral sodium acetate containing 24 grams in 100 c.c. of water. 20 c.c. of the wine is placed in a test-tube, and 2 c.c. of the tannin solution added; after shaking, 3 c.c. of the acetate solution is poured into the tube. If, after five minutes, a flocculent precipitate is formed, the wine is adulterated (that is, contains more than 0·1 gram of alum per litre); if, however, the solution remains clear, or becomes only slightly opaque, the wine is natural.

If it is required to estimate the alum present, 500 c.c. of the wine is taken, and a volume of the solutions corresponding with 1 gram of tannin, and 25 grams of sodium acetate added; the precipitate is then collected, ignited, and weighed as alumina. J. F. T.

Detection of Cobalt by Nitroso-β-naphthol. By MICHAEL VON ILINSKI (*Chem. Zeit.*, 1895, **19**, 1421).—The test is best carried out by adding to the solution to be tested an acetic acid solution of nitroso-β-naphthol; on heating, a voluminous, dark red precipitate is formed. To guard against the separation of nitroso-β-naphthol, which may be mistaken by the inexperienced for the cobaltic compound, the author recommends adding an equal bulk of alcohol.

Traces of cobalt are best detected by omitting the alcohol and adding a cold aqueous solution of the reagent. It is necessary that the cobalt solution should contain free hydrochloric acid, also that the reagents should be freshly prepared. The test works well in the presence of nickel. L. DE K.

Analysis of Tin Slag. By HENRY BAILEY (*Chem. News*, 1896, **73**, 88).—Tin slag consists chiefly of double silicate of iron and aluminium with some stannous silicate, shots of metal, small quantities of lime, tungsten, &c., and, occasionally, unreduced stannic oxide. The iron, tin, and silica are usually estimated, and for this purpose the following method is suggested: 2 grams of the finely pulverised slag is evaporated with 10 c.c. of fuming nitric acid until nitrous fumes cease to be evolved; it is then boiled for some time with 20 c.c. of strong hydrochloric acid, diluted with an equal bulk of water, reduced with zinc, filtered, and washed. The iron in the filtrate is estimated by means of potassium dichromate. The washed residue is warmed with 10 c.c. of hydrochloric acid and a few drops of nitric acid, to oxidise any tungsten, diluted, filtered, washed with boiling water, and the warm filtrate and washings treated with hydrogen sulphide; it is then left to settle in a warm place, collected, washed, dried, ignited, and weighed as stannic oxide. The silica is washed with dilute ammonia, subsequently with water, dried, ignited, and weighed; by evaporating and igniting the ammoniacal washings in a platinum dish, and weighing the tungsten oxide, an idea of the amount of tungsten present is obtained. To estimate alumina, the solution containing the iron and alumina is nearly neutralised with sodium carbonate and boiled with 10 grams of sodium thiosulphate until the odour of sulphurous anhydride has disappeared. The precipitate is washed, dried, ignited, and weighed, and the solution is acidified with hydrochloric acid, boiled until free from sulphurous anhydride, and then titrated with standard dichromate.

D. A. L.

Testing Petroleum by Fractional Distillation. By RICHARD KISSLING (*Chem. Zeit.*, 1895, **19**, 1227).—The author, in reply to Engler, states that his own apparatus gives constant results, and shows small differences in the composition of the samples. This cannot be said of Engler's distillation apparatus. L. DE K.

Detection of Paraffin in Olive Oil. By E. CARPENTIER (*Chem. Centr.*, 1895, ii, 664; from *Bull. l'Assoc. Belge Chim.*, 1895, 75).—Saponification and agitation of the soap solution with ether is impracticable, as a firm emulsion is obtained. For a quantitative estimation, 10 grams of the oil is saponified with alcoholic soda, and the solution evaporated to dryness at 80—90°. The residue is then rubbed with sand and extracted in a Soxhlet apparatus with light petroleum.

If a qualitative test only is desired, the soap solution is decomposed by an acid, and the mixture of fatty acids and paraffin is filtered off. This is then dissolved in alcohol, carefully neutralised with alcoholic potash, and diluted with water. If paraffin is present, the solution will become turbid. L. DE K.

Estimation of Oil of Mustard. By OTTO FOERSTER (*Chem. Zeit.*, 1895, **19**, 2002).—The author states that his method of estimating the sulphur in oil of mustard by means of ammonia and mercuric oxide, and weighing the resulting mercuric sulphide, is preferable to the alkaline permanganate process proposed by Schlicht. It is admitted, however, that the results are only approximate.

L. DE K.

Assay of Glycerol for the Manufacture of Dynamite. By JULIUS LEWKOWITSCH (*Chem. Zeit.*, 1895, **19**, 1423—1425).—The sample should be fairly pure, as impurities constitute a source of danger. The sp. gr. should not be less than 1·261 at 15·5°. Lime, magnesia, and alumina should be absent. Chlorine or arsenic should not exceed a trace. Organic acids and other organic matter should be absent.

A sample which passes all these tests may still be unfit for manufacturing nitroglycerol, and a practical test should therefore be made.

The nitro-product should readily and completely separate from the acid, and may then be measured. The yield should be at least 207—210 per cent.; 246·7 per cent. is the theoretical quantity. The author gives a number of precautions to be observed when making the practical test, which should only be attempted by an experienced operator. L. DE K.

Estimation of Water in Raw Sugars. By JAN W. GUNNING (*Chem. Centr.*, 1895, ii, 948; from *Sucrerie Belge*, **23**, 180).—One hundred grams of the sample of beetroot sugar is dried for five hours at 108°; the drying is attended with a very slight decomposition, and about 0·1 per cent. of the loss is caused by carbonic anhydride and traces of volatile bases. When drying raw canesugar, the fatty acids contained therein cause a slight inversion and also partial destruction of the levulose, which also happens if the sample is heated out of contact with oxygen. L. DE K.

Estimation of Pentoses and Pentosans by means of the Furfuraldehyde Reaction. By A. STIFT (*Chem. Centr.*, 1895, ii, 67; from *Österr.-ung. Zeit. Zucker-Ind.*, **24**, 290—294; compare this vol., ii, 79).—The estimation of furfuraldehyde in molasses and osmose waters is very difficult, on account of the persistent foaming during the distillation with hydrochloric acid, and the incomplete precipitation of the distillate by phenylhydrazine acetate.

The precipitate should be dried in a vacuum. Multiplication by 2·09 and 1·84 gives respectively the pentose or pentosan number. L. DE K.

Behaviour of Sugars towards Alkaline Copper Solution. By JOHAN G. C. T. KJELDAHL (*Chem. Centr.*, 1895, ii, 665; from *Carlsberg. Lab. Meddelser.*, 1895, **4**).—The author states that the quantity of copper precipitated from Fehling's solution by glucose is seriously diminished by free access of air. Experiments were made with narrow-necked flasks, a beaker, a deep basin, and a very flat dish; by using the latter, a loss of nearly 0·02 gram of copper was caused. Trustworthy results can only be obtained by working in a current of hydrogen.

The products of oxidation of the sugar are, besides formic acid, glycollic acid, glyceric acid, trihydroxybutyric acid, arabonic acid, and gluconic acid. It is a curious fact that glucose and fructose, when boiled with Ost's copper solution, precipitate about twice as much copper as from Fehling's solution. L. DE K.

Estimation of Sugars by means of Copper-potassium Carbonate. By HERMANN OST (*Chem. Zeit.*, 1895, **19**, 1784—1785, 1829—1830).—Instead of Fehling's solution, the author uses a liquid prepared by dissolving 17·5 grams of copper sulphate in water, and pouring this slowly into a solution of 250 grams of pure potassium carbonate and 100 grams of potassium hydrogen carbonate. The solution is then made up to a litre. In some cases, it is advisable to reduce the amount of copper sulphate to 3·6 grams. These solutions are said to keep better than the Fehling liquid, but, as they are reduced by much less sugar, the author's tables should be consulted. These include the reducing powers of dextrose, levulose, maltose, and mixtures of invert and cane sugar. Cane sugar is said to be scarcely affected by the new solution. If the sugar solution contains traces of lead or calcium, these must be first removed by ammonium oxalate.

L. DE K.

Behaviour of Basic Lead Acetate towards Sugar Solutions. By HANNO SVOBODA (*Zeit. Ver. Rübenzucker-Ind. Deut. Reichs.*, 1896, **46**, Heft 481).—See this vol., i, 406.

Estimation of the Acidity of some Pyroligneous Products. By AUGUSTE SCHEURER-KESTNER (*Compt. rend.*, 1896, **122**, 619—621). —Crude pyrolignic acid, made by distilling wood in closed vessels, contains, amongst other products, methylic acetate; the quantity of this can be ascertained by first titrating the solution with sodium hydroxide in the cold, then adding excess, and boiling for some hours. On titrating back, the difference in the two results gives the quantity of methylic acetate and similar products present. The author also describes a method of titration in the presence of phenols.

J. F. T.

Oxalic acid and Putrefaction. By DIOSCORIDE VITALI (*L'Orosi*, 1895, **18**, 304—307).—The possible contingency that oxalic acid used as a poison may undergo change during the putrefaction following death and thus escape detection does not seem to have been considered by toxicologists. On allowing a mixture of water with 100 grams of meat, the white of one egg, and 2 grams of oxalic acid to remain for nine months, putrefaction seemed to be appreciably retarded, but the greater part of the oxalic acid could still be detected in the ordinary way. W. J. P.

Improvement on Hübl's Chloro-iodine Process. By WALLER (*Chem. Zeit.*, 1895, **19**, 1786—1787; 1831—1832).—The paper deals at great length with the theory of the Hübl's solution. As is well known, this reagent rapidly deteriorates in strength; by the author's new way of preparing it, it may be kept at nearly full strength for two months.

Twenty-five grams of iodine is dissolved in 250 c.c. of 95 per cent. alcohol, a solution of 25 grams of mercuric chloride in 200 c.c. of alcohol is added, then 25 grams of hydrochloric acid of 1·19 sp. gr., and the whole is made up with alcohol to 500 c.c., being, therefore, double the strength of the ordinary Hübl solution. L. DE K.

Testing Vegetable Oils and Butter. By P. LEVIN (*Chem. Zeit.*, 1895, **19**, 1832—1833).—An attack on Schönvogel's borax process. Borax is of no use for the detection of vegetable oils in butter, as the emulsion will always form if fatty acids are present. Rancid butter, when tested with borax solution, appears adulterated, whilst some vegetable fats give no emulsion at all. L. DE K.

Estimation of the Acetyl Numbers of Lard, Cotton-seed Oil, and Tallow. By ED. SPAETH (*Chem. Centr.*, 1895, ii, 623; from

Forsch.-Ber. Lebensm., **2**, 226—227).—The author has taken the acetyl numbers of three kinds of lard, two specimens of cotton-seed oil, and a sample of tallow, also of a mixture of lard with cotton-seed oil and tallow, and has tabulated the results.

The conclusion drawn is that for the detection of cotton-seed oil the process gives no better result than the iodine absorption process.

L. DE. K.

Testing of Lard. By H. VOGEL (*Chem. Centr.*, 1895, ii, 845; from *Apoth. Zeit.*, **10**, 633—634).—Lard is often adulterated with cotton-seed oil and tallow, and, with care, mixtures can be made which defeat most of the recognised tests. The best results are obtained by testing the liquid fatty acids. 50 c.c. of the sample is saponified, and the fatty acids are dissolved in 250 grams of carbon bisulphide and 8—10 grams of zinc oxide. The zinc salts of the solid fatty acids are deposited, and those of the liquid acids remain in solution. The carbon bisulphide is distilled off, and the residue is decomposed with hydrochloric acid. The liberated oleïc acid is finally tested in the oleorefractometer at 45°, when the deviation should be −30, or it may be titrated; 1 gram should neutralise 0·190—0·191 gram of potassium hydroxide.

L. DE K.

Analysis of Lard and similar Fats. Detection of Vegetable Oils. By FERDINAND JEAN (*Bull. Soc. Chim.*, 1895, [3], **13**, 780—784).—The determination of the refractive index both of the original substance, and of the liquid fatty acids obtained from it, the iodine absorption of the liquid fatty acids, and the quantity of potassium hydroxide necessary to neutralise 1 gram of these acids, yield data from which the presence or absence of vegetable oils can readily be inferred.

A refractive index less than −12·5° (at 45°) for the crude substance, and less than −30° for the liquid fatty acids obtained therefrom, together with a quantity of potassium hydroxide less than 0·0190 gram being required, is, in the author's opinion, sufficient evidence of the presence of vegetable oils.

J. F. T.

Detection of Cotton-seed Oil in American Lards. By J. DUPONT (*Bull. Soc. Chim.*, 1895, [3], **13**, 775—780).—The figures usually taken as representative of a pure sample of European lard are the following: Index of refraction, −12·5°; iodine absorption, 59; action on silver nitrate, none; any figures higher than these being supposed to indicate the presence of cotton-seed oil.

The author has determined the index of refraction and the iodine absorption of the following samples of American lard:—I, leaf lard; II, back lard; III, belly lard; IV, head lard; V, foot lard; VI, gut lard; VII, rancid lard; VIII, sour lard; IX, a sample taken at hazard from the boilers; X, lard oil (Wilcox); XI, lard oil (John Morrell).

	I.	II.	III.	IV.	V.	VI.
Index of refraction..	−11·5°	−5°	−7°	−7°	−4°	−11°
I absorption	58	61	62	63	65	60

	VII.	VIII.	IX.	X.	XI.
Index of refraction	−7°	−6·5°	−7°	−1°	0°
I absorption	63	64	63	80	82

The action of the free acids on silver nitrate solution was in every case negative, Nos. VII and VIII only being somewhat doubtful.

It is, therefore, concluded that the figures usually taken as representative of a pure French lard cannot be applied to samples of American lard, owing to the difference in race and nourishment of the animals and in the mode of preparation of the product.

J. F. T.

Rapid Estimation of Wax-substitute in Bees-wax. By Georg Buchner (*Chem. Zeit.*, 1895, **19**, 1422).—The well-known Hübl test for wax may be defeated by using a judiciously made mixture of stearic acid or resin, with stearin, or japan-wax and paraffin, or ceresin. These mixtures, which can be readily detected qualitatively, all yield to alcohol a large amount of soluble matter of an acid nature, whilst pure wax only gives a small amount of cerotic acid.

Five grams of the suspected sample is boiled with 100 c.c. of 80 per cent. alcohol for five minutes. After cooling, the loss caused by evaporation is carefully restored by adding more alcohol, and the liquid is then filtered. 50 c.c. of the filtrate is titrated with N/10 potash, using phenolphthaleïn as indicator. If the calculated acidity number does not exceed 4·1, the wax may be considered pure; any considerable excess may be put down to the presence of a substitute. As the nature of the latter is known by a qualitative analysis, the amount may be readily calculated by referring to the author's tables. For instance, a mixture of stearic acid, stearin, and ceresin which, by the Hübl test, would appear to be pure wax, has an acidity number of 21·4; a mixture containing resin instead of stearic acid has an acidity number of 22. L. de K.

Testing Acetone. By Hugo Schweitzer and Emil E. Lungwitz (*Chem. Zeit.*, 1895, **19**, 1384).—To test acetone for water, the authors recommend adding to 50 c.c. of the sample 50 c.c. of light petroleum (boiling point 40—60°). If water is present, two distinct layers will be visible. The reaction is not, however, a quantitative one, as the aqueous layer does not consist of pure water.

In the absence of water, a perfectly clear mixture is obtained.

L. de K.

Volumetric Estimation of Antipyrine. By M. C. Schuyten (*Chem. Zeit.*, 1895, **19**, 1786).—Antipyrine may be titrated by adding N/50 iodine solution to an aqueous solution of 0·01—0·05 gram of the sample in 1000 times its weight of water, until the liquid turns permanently yellow. The iodine should be added slowly, and no more of it should be added unless the yellow colour has completely disappeared. The reaction is finished if, after one hour, the liquid is still visibly yellow. It is as well to do a blank experiment side by side with pure water. Starch is not to be recommended as indicator in this case. 1 part of iodine represents 1·45 part of antipyrine. L. de K.

General and Physical Chemistry.

Reversal of the Double Refraction of Gelatin producing Tissues by Various Reagents. By VICTOR VON EBNER (*Monatsh.*, 1896, **17**, 121—125).—The author has previously shown that the double refraction of such colloidal substances as connective tissue, cartilage, decalcified bones and teeth, cornea of the eye, capsule of the crystalline lens, elastic tissue, chitin and spongin, is reversed, that is, changed from positive to negative, or *vice versâ*, when the substances are treated with phenol. Muscle, horny tissue, silk, cellulose, wood, cork, starch, exhibit no such change. It has also been shown that other phenolic substances have a similar power, but neither inorganic nor aliphatic compounds.

The action of various other organic compounds on longitudinal sections of decalcified bone has been studied. Pure aniline, eugenol, carvacrol, orthocresol, guaiacol, all change the positive double refraction to negative. Salicylaldehyde has the greatest action of all, and induces a negative double refraction far greater than the original positive. Crotonaldehyde and citronelaldehyde, propaldehyde and isovaleraldehyde, ethylic acetoacetate, geraniol, menthylic valerate and bornylic acetate have no action. J. J. S.

Argon. By SIEGFRIED FRIEDLÄNDER (*Zeit. physikal. Chem.*, 1896, **19**, 657—667).—The author has examined the spectrum of argon as prepared by Guntz's method (Abstr., 1895, ii, 347), and gives the wave-length and intensity in the case of 106 lines which he has observed and measured. Of these, however, 33 seemed coincident with mercury, sodium, lithium, nitrogen, or hydrogen lines, and these disappeared by further sparking, with the exception of an apparent N line at $l = 420\mu\mu$, which is hence probably a true argon line, so that 74 lines due to argon still remain. By continuing the induction sparks "electric vaporisation" of the platinum was observed, while the number and intensity of the argon lines decreased, and ultimately all disappeared, the D_3 helium line being finally visible for a few seconds. It hence appears that by the continued action of the electric discharge argon combines with platinum (compare Troost and Ouvrard, this vol., ii, 99). Helium also is present in atmospheric air, but probably not to a greater extent than $1/10^9$, and it also combines with platinum under the above conditions (compare Brauner, Abstr., 1895, ii, 347). A list of 11 almost coincident lines of helium and argon is given, the helium wave-lengths being taken from Runge and Paschen's measurements (this vol., ii, 1). The similarity of the spectra of the two gases is, the author considers, a probable indication of their chemical similarity, so that argon, like helium (this vol., ii, 1), probably consists of two elements, a view he considers further supported by the *simultaneous* dual spectrum of argon (this vol., ii, 104). L. M. J.

Absorption Spectra of Iodine and Bromine Solutions above the Critical Temperature of the Solvent. By R. W. Wood (*Zeit. physikal. Chem.*, 1896, **19**, 689—695).—The absorption spectrum of a solution of iodine in carbon bisulphide consists of two bands, red and violet, whilst that of gaseous iodine consists of a number of fine lines. Solutions of iodine in varying quantities of carbon bisulphide were heated in closed tubes to above 300°, and the concentration of the iodine varied until the line spectra became visible, at which point the density of the carbon bisulphide vapour and concentration of the iodine were calculated. These values being represented graphically yield a curve consisting of two straight lines, but similar experiments with bromine gave a curve concave to the axis of bromine concentration. The ratio of the bromine to iodine content at similar solvent density, varied from 6·1 to 9·4, and increased with the concentration. The results are, as the author points out, analogous to those obtained by Hannay and Hogarth for solutions of solids, at temperatures above the critical temperature of the solvent (*Proc. Roy. Soc.*, 1880, **30**, 178 and 484). L. M. J.

Optical Superposition of Six Asymmetric Carbon Atoms in the same Active Molecule. By Philippe A. Guye and Charles Goudet (*Compt. rend.*, 1896, **122**, 932—934).—Determinations of the rotatory powers of three active amylic tartrates confirm Walden's results, and his conclusion that the total effect of the four asymmetric carbon atoms is the algebraic sum of their separate effects.

Consideration of the extended formula of amylic divaleryltartrate shows that it contains six asymmetric carbon atoms in three pairs. If prepared (1) from constituents all of which are inactive except the amyl radicle, the compound should have the optical effect of the pair of asymmetric carbons in the two COO·CHMeEt groups, symmetrically disposed at the end of the main chain; if (2) from racemic tartaric acid, racemic amylic alcohol, and active valeric chloride, it should have the rotatory power of the central pair of carbons; whilst if prepared (3) from active tartaric acid, all the other constituents being inactive, the rotatory power should represent the effect of the pair of carbons in the other COO·CHMeEt groups disposed laterally and unsymmetrically with respect to the main chain. A fourth modification, prepared from wholly active constituents, should have a rotatory power equal to the sum of the other three.

		Molecular refraction.		Rotatory
Ethereal salt.	Sp. gr.	Observed.	Calculated.	power, $[\alpha]_D$.
1	1·0095	119·84	120·05	+2·44
2	1·0066	120·09	120·05	+3·48
3	1·0172	119·06	120·05	+6·42
4	1·0089	119·96	120·05	+11·32

It will be seen that the rotatory power of No. 4 is practically equal to the sum of the rotatory powers of the other three, and this result affords a further and remarkable proof of the independence and the algebraic superposition of the optical effects of different asymmetric carbon atoms in one and the same optically active molecule.

C. H. B.

Rotatory Dispersion of Non-polymerised Optically Active Liquids. By PHILIPPE A. GUYE and CHARLES JORDAN (*Compt. rend.*, 1896, **122**, 883—886).—As a rule, the rotatory power of a substance for different rays of the spectrum increases with the refrangibility of the rays; this is *normal rotatory dispersion.* With some substances, however, the rotatory power may have opposite signs with different rays, or, whilst retaining the same sign throughout the spectrum, may show a maximum at some particular point; either of these cases is *abnormal rotatory dispersion.*

The authors have measured, by Landolt's method (Abstr., 1895, ii, 1), the rotatory power for different rays of some 13 substances, including a hydrocarbon, a halogen derivative of a hydrocarbon, ethereal salts, and amines, all of them being free from molecular polymerisation as defined by Ramsay and Shields. Tables are given showing (1) the observed rotatory powers for red, yellow, green, blue, and violet; (2) the coefficients of rotatory dispersion, or the ratio of the rotatory power for the particular ray to the rotatory power for red; and (3) the specific rotatory power, the specific dispersion, and the specific rotatory dispersion, the latter being the difference between the specific rotatory powers for red and violet respectively.

The general conclusions are: (1) the non-polymerised optically active liquids show only normal rotatory dispersion; (2) each active compound has its own law of rotatory dispersion; (3) the coefficients of dispersion in the violet have no relation whatever to the magnitude of the rotatory power; (4) whilst the specific rotatory dispersion is not proportional to the specific rotatory power, the order of magnitude of the two quantities generally varies in the same direction; (5) the specific rotatory dispersion, like the specific rotatory power, is a characteristic constant of a chemical compound; (6) there is no simple relation between the refractive effect on different rays and the rotatory dispersion.

C. H. B.

Photochemistry and Thermophotochemistry. By RODOLFO NAMIAS (*Gazzetta*, 1896, **26**, i, 35—52).—The author discusses at length the various chemical changes attending photographic action. Although light can cause both endothermic and exothermic reactions to occur, the former only proceed, as a rule, to a very slight extent, owing to the reverse exothermic reaction setting in between the decomposition products. The usefulness of chemical sensitisers is due to their being able to react exothermally with certain of the decomposition products, and so facilitate the photographic action. In exothermic reactions, the light acts merely as an exciting agent, but in endothermic reactions it plays the part of a source of energy; all endothermic photographic reactions cease when the light ceases to act, and those reactions which continue in the dark after cessation of the light action must be exothermic.

W. J. P.

The Potential Difference between Gases and Liquids. By Frank B. Kenrick (*Zeit. physikal. Chem.*, 1896, **19**, 625—656).—A difference of potential has been proved to exist at the surface of separation of gases and liquids, and drops of water falling through, receive, and impart to the air electrical charges when they reach an obstacle. The solution of dissociable compounds usually diminishes this effect, whilst that of organic compounds markedly increases it. The formation of "double-layers" at the surface of separation is the cause usually assigned to these phenomena. The author has endeavoured to determine this difference of potential in the case of various liquids. The paper contains details of the method, the essential principle of which is the measurement of the E.M.F. of the chains *n*KCl | liquid 1 | air | liquid 2 | *n*KCl, and *n*KCl | liquid 1 | liquid 2 | *n*KCl. Experiments were made with solutions of hydrochloric, nitric, and sulphuric acids, and sodium sulphate; formic, acetic, and butyric acids, ethylic and amylic alcohols; ether and ethylic benzoate. As expected, the effect of the electrolytes was small, but that of the non-electrolytes was frequently very considerable, whilst in most cases the velocity of formation of the double layer is so great as to be independent of the velocity of formation of the liquid surface. The absolute potential differences were calculated on the assumption that between air and a 0·011 per cent. solution of sodium chloride, no difference of potential exists, Lenard having found that when drops of this solution fall upon an obstacle no electric charges are produced. Curves are given with E.M.F. ordinates and concentration abscissæ, the character of the curves being very similar to those in which the ordinates represent the lowering of the surface tension of water. Experiments were also made in which illuminating gas replaced air, but this substitution appeared to have little, if any, effect on the potential differences. L. M. J.

Catalytic Action of Nitrous acid and the Potential of Nitric acid. By Rudolf Ihle (*Zeit. physikal. Chem.*, 1896, **19**, 577—591).—If the oxidation of the hydrogen ions in the case of a Grove's cell is not sufficiently rapid, polarisation occurs, and the E.M.F. falls considerably. This oxidation velocity is largely dependent on the concentration of the acid, and is increased by the addition of small quantities of nitrous acid. Thus, although polarisation with a pure acid occurred when the concentration was 35 per cent., by the addition of 5 drops of a nitrite solution the acid could be further diluted to 20 per cent. without any polarisation. Owing to this action of nitrous acid, urea and strong oxidising agents, such as potassium permanganate, have a retarding effect on the oxidation velocity, which may further be increased by some reducing agents. The potential of the nitric acid increases with the concentration, the values 1·23 volt at 6 per cent., and 1.52 volt at 95·5 per cent. being obtained. Nitrous acid, however, lowers the potential, and its effect in this respect was found to be a logarithmic function of its concentration. The potential of nitrous acid itself was found to be lower than that of nitric acid. L. M. J.

Polarisation and Resistance of a Galvanic Cell. By Franz Streintz (*Ann. Phys. Chem.*, 1896, [2], **57**, 711—730).—In any closed circuit containing a galvanic cell and a voltameter, it is impossible to obtain any method for determining the polarisation during the course of electrolysis. For, as the author shows, not only is the electromotive force a function of the strength of the current, but the resistance also changes with this, or rather with the density of the current on the electrodes. H. C.

Measurement of the Electrochemical Forces of Accumulators. By PAUL SCHOOP (*Chem. Centr.*, 1895, i, 521; from *Zeit. Electrotechn. u. Electrochemie*, 1894, 234—243).—Attention is called to the present method of estimating the efficiency of accumulators only from the ratio of the charge given to that obtained from the cell, and it is pointed out that this does not afford a criterion of the suitability of the different types of accumulator for special purposes. The durability is never determined, but merely deduced from practical experience. In measurements of the efficiency and durability, attention should be simultaneously directed to the seven principal parts of any secondary cell, the active material of the positive and that of the negative plate, the materials of the plates themselves, the electrolyte, the insulation between the electrodes, the containing vessel. The author gives an account of experiments on accumulators in which these different points are taken into consideration, and shows that they afford data for estimating the suitability of secondary cells for different purposes. An improved form of cell is described, in which, by means of a special arrangement of the plates, a continual circulation of the electrolyte is rendered possible. H. C.

Electromotive Force and Partition Equilibrium. By ROBERT LUTHER (*Zeit. physikal. Chem.*, 1896, **19**, 529—571).—The author deduces theoretically the conclusion that electric cells consisting of different solutions in equilibrium with the same solution (for example, saturated solutions in different solvents) should possess an E.M.F. independent of the nature of the second solvent. This is proved in the case of the chains Hg | $HgSO_4$ | saturated $ZnSO_4$ | Zn, Hg | $HgSO_4$ | saturated $CdSO_4$ | Cd, and Hg | $HgSO_4$ | saturated $CuSO_4$ | Cu, the solvents being methylic and ethylic alcohols at different concentration. For the zinc chain, the E.M.F. was found to be 1·423, the other metals yielding the values 1·057 and 0·358, and the result was practically independent of the temperature. By a similar series of experiments with N/10 and N/100 solutions, curves were obtained for E.M.F./alcoholic content, from which, by the close coincidence of the methylic and ethylic alcohol curves, it appears that solutions in these solvents of equal concentration are appoximately in equilibrium. From the curves may also be found the alcoholic content of a saturated solution required to be in equilibrium with a definite aqueous solution. The difference of potential for Hg | $HgSO_4$ in aqueous alcohol was determined by the aid of a capillary electrometer at different alcoholic (methylic and ethylic) content, and hence the author obtains the values for Zn | $ZnSO_4$, Cd | $CdSO_4$, and Cu | $CuSO_4$. The + potential difference falls rapidly with increasing alcoholic concentration, hence indicating that the dissociation decreases more rapidly than the solution tension of the metal. The differences of potential between the aqueous and alcoholic solutions (N/10 and N/100) are also calculated, the values being independent of the concentration and of the nature of the kation. This potential difference, as well as the alteration of the potential difference, metal | electrolyte, is greater for the solvent possessing the smaller dielectric constant, namely, ethylic alcohol. L. M. J.

Use for Laboratory Purposes of the Electric Arc from the Low Potential Alternating Current. By MILO S. WALKER (*Amer. Chem. J.*, 1896, **18**, 323—328).—The author suggests, for high temperature experiments, the use of an electric arc obtained from an alternating current of low potential (about 50 volts and 1—5 ampères), the current being regulated by means of a rheostat capable of transmitting 12 ampères. Such an arc may be used for the following purposes: (1) To show the effect of high temperatures on substances which are "non-volatile" or fusible only with difficulty. (2) For reducing metallic oxides. (3) As a partial substitute for the blowpipe in qualitative analysis. (4) For the synthetic production of some carbon compounds from their elements.

The compound experimented on is conveniently retained in a conical cavity in the lower carbon, and the author further suggests that, where the object of the experiment is the reduction of oxides, a tube of carbon be used in place of the common rod-form of the upper carbon; in such a case, a stream of hydrogen or coal-gas, passed through the central core while the metal is cooling, will effectually prevent reoxidation. A. L.

Conductivity of Yttrium Sulphate. By HARRY C. JONES and CHARLES R. ALLEN (*Amer. Chem. J.*, 1896, **18**, 321—323).—The molecular conductivity of yttrium sulphate in solutions of varying degrees of concentration was determined with the aid of the Kohlrausch apparatus. The results are given in the following table, where ν = number of litres of solution containing a $\frac{1}{6}$ gram-molecule of the sulphate, and μ_ν = corresponding molecular conductivity.

ν.	μ_ν.	ν.	μ_ν.
6·49	23·2	1161·44	102·6
12·98	27·8	3322·88	123·8
25·96	32·5	6645·76	152·6
51·92	38·5	13291·52	192·9
103·84	36·9*	26583·00	240·7
207·68	54·0	53166·00	333·3
415·36	66·6	106332·00	601·1
830·72	78·8		

A. L.

Conductivity of Solutions of Acetylene in Water. By HARRY C. JONES and CHARLES R. ALLEN (*Amer. Chem. J.*, 1896, **18**, 375—377).—The acetylene was prepared by heating cuprous acetylide with a solution of potassium cyanide. The strength of the solution was ascertained within two or three minutes of the measurement of conductivity at 0° by drawing off a known volume in a pipette, adding a N/10 solution of silver nitrate and an exactly equivalent quantity of potassium chloride, and then titrating the excess of potassium chloride by means of silver nitrate, potassium chromate being used as an indicator.

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* This is probably a misprint for 46·9 (Abstractor).

In the table, v = volumes in litres, which contains $\frac{1}{2}$ gram-molecule of acetylene, μ_v = molecular conductivities at the volumes v.

v.	μ_v.
417	29·0
833	41·0
1111	50·0
2502	77·0

Although somewhat vitiated by unavoidable errors due to loss of gas from the solutions, these numbers show that solutions of acetylene in water are somewhat dissociated, and that this dissociation increases with the degree of dilution. These results are in accord with the feebly acid character of the compound. A. G. B.

Decrease of Conductivity when the Water of Solution is replaced by Alcohol. By J. F. Carl Schall (*Zeit. physikal. Chem.*, 1896, **19**, 699—700; see Abstr., 1894, ii, 439).—A note regarding the purity of the methylic and ethylic alcohols employed in the observations recorded in the former paper. The author notes the peculiarity that, after prolonged dehydration of methylic alcohol, renewed distillation over sodium produced an increase in the conductivity. L. M. J.

Heats of Electrolytic Dissociation of some Acids. By Frederick L. Kortright (*Amer. Chem. J.*, 1896, **18**, 365—371).—The author has determined the heats of electrolytic dissociation of a number of acids of different but allied constitution. The measurements were made by the Ostwald-Kohlrausch method (Ostwald, *Handb. physiko-chemische Messungen*, 266). The actual measurements and the formulæ, by means of which the value of the heats of electrolytic dissociation were calculated from them, are given. In the following table, positive q is the heat absorbed if the electrolytic dissociation takes place without outside work.

Acid.	q 12·5°.	Acid.	q 12·5°.
Acetic	−428 cal.*	Phthalic........	+162 cal.
Chloracetic....	−999 „	Isophthalic	+2260 „
Bromacetic....	−790 „	Succinic........	+1697 „
Dichloracetic ..	−2924 „ †	Maleic	+846 „
Malonic	+966 „	Fumaric........	+970 „
Butyric	−696 „	Mesaconic	+518 „
Benzoic	−335 „	Citraconic......	−522 „

* From Jahn's table at 18°.

† „ Arrhenius's table at 21·5°.

These figures confirm the result of Arrhenius and Jahn that monobasic acids dissociate electrolytically with development of heat, and show that the latter is increased by the introduction of a halogen atom, the effect of a second halogen atom being greater than that of the first. On the other hand, the introduction of a carboxyl group into the acid causes an absorption of heat, and the further the carboxyl groups are removed from each other the greater the absorption.

A. G. B.

Formation of Ammonia by the Electrolysis of Nitric acid. By RUDOLF IHLE (*Zeit. physikal. Chem.*, 1896, **19**, 572—576).—The author investigated the conditions under which ammonia is formed at the cathode during the electrolysis of nitric acid, the formation being found to depend on both the current density and the strength of the acid. Thus for acids of 14·67, 28·73, 43·34, and 85·37 per cent. HNO_3, current densities of 0·00159, 0·01122, 0·0564, and 8·6 ampères/sq. cm. were respectively required before any trace of ammonia was obtained. With increased currents, the quantity of ammonia formed was also increased. L. M. J.

Absorption of Radiant Heat by Liquids. By RICHARD ZSIGMONDY (*Ann. Phys. Chem.*, 1896, [2], **57**, 639—645).—Basing his observations on the experiments of Friedel (*Ann. Phys. Chem.*, 1895, [2], **55**, 453), the author points out that certain radicles or groups of elements exercise a very marked influence on the absorption of radiant heat by liquids. This is particularly noticeable in the case of the hydroxyl and amidogen groups, the introduction of which into any liquid hydrocarbon serves to greatly increase the absorption of radiant heat by these liquids. The author compares the behaviour of these groups with that of the auxochromic groups which convert coloured or colourless substances into dye-stuffs. It appears, further, that it is these auxochromic groups, to which amidogen and hydroxyl belong, which increase the absorption of radiant heat by colourless liquid hydrocarbons, and therefore that such groups increase generally the absorptive power of substances into which they are introduced.

H. C.

Boiling Points in a Cathode-light Vacuum. By FRIEDRICH KRAFFT and H. WEILANDT (*Ber.*, 1896, **29**, 1316—1328).—A mercury manometer affords no accurate measurement of very low pressures. Using von Babo's pump (this vol., ii, 89), the pressure can be reduced to about a millionth of an atmosphere, as is indicated by the appearance of the green fluorescence in the glass of a Hittorf's tube attached to the distillation apparatus, when an induction current is sent between the platinum terminals. The distillation flask used had a capacity of about 15 c.c., and was in one piece with the receiver; the tube leading to the pump and to the Hittorf's tube was connected with the end of the receiver by means of an india-rubber stopper or a ground glass joint, and the thermometer passed through a rubber stopper in the neck of the flask. The receiver was covered with moist filter-paper on which lumps of ice were placed; it was, of course, only possible to experiment with substances that, at this temperature of the receiver, have no appreciable vapour pressure;

with more volatile substances, a vacuum of a millionth of an atmosphere cannot be obtained. Such substances are the higher paraffins; cetylic alcohol, chloride, and iodide; the higher fatty acids and their amides; the higher acids of the oleic and oxalic series; alkylbenzenes of high molecular weight; mixed aliphatic-aromatic ketones of high molecular weight; and lastly, sulphobenzide and dinaphthyl sulphides and sulphone. It was found that in all these cases a great lowering of boiling point was brought about by the last small reduction of pressure; the difference in the boiling point under 15 mm. pressure and in the cathode-light vacuum varied, for the substances examined, from 70° to 100°. C. F. B.

Thermochemistry of Oxybromides and Oxychlorides of the Calcium Group. By TASSILLY (*Compt. rend.*, 1896, **122**, 812—814).—The author has measured the heat of dissolution in dilute hydrobromic acid of the oxybromides of the metals of the calcium group (Abstr., 1895, ii, 45 and 304), and from the results has deduced the heat of formation of the solid salts from their proximate constituents.

	Heat of dissolution.	Heat of formation.	
		Liquid water.	Solid water.
(1) $CaBr_2,3CaO,3H_2O$ ..	+95·7 Cal.	+66·7 Cal.	+62·5 Cal.
(2) $SrBr_2,SrO,9H_2O$....	+16·45 „	+54·35 „	+41·75 „
(3) $SrBr_2,SrO,3H_2O$.. .	+38·30 „	+32·5 „	+28·3 „
(4) $BaCl_2,BaO,5H_2O$ ...	+18·5 „	+39·2 „	+32·2 „
(5) $BaBr_2,BaO,5H_2O$ ...	+19·5 „	+41·2 „	+34·2 „
(6) $BaBr_2,BaO,2H_2O$...	+33·80 „	+26·90 „	+24·1 „

The barium oxychloride was dissolved in dilute hydrochloric acid. The lower hydrates are obtained by carefully heating those which contain a larger proportion of water. C. H. B.

Heat of Combustion of Cyanogen Derivatives. By J. GUINCHANT (*Compt. rend.*, 1896, **122**, 943—945).—

	Heat of combustion, 1 gram.	Molecular heat of combustion.		Heat of formation.
		Const. vol.	Const. pres.	
Cyanacetic acid...	7047	299·4	299·0	87·2
Cyanacetamide ...	4485	376·7	376·4	44·2
Cyanacetophenone.	7487	1085·7	1086·1	3·6
Benzoic cyanide ..	7180	940·6	940·7	−14·2

Comparison of these results and also of those of other observers, for a large number of cyanogen derivatives, with those obtained with the compounds from which they have been derived, the necessary corrections for differences of physical condition being made, shows that the substitution of cyanogen for hydrogen in the group CH_3 or CH_2 in union with other carbon radicles increases the heat of combustion by about 90 Cal., or reduces the heat of formation by about 30 Cal. No relation can be traced between the differences between the heats of combustion and the intensity of the acid function of the cyanogen derivative. C. H. B.

Heats of Solution and Neutralisation of Nitrocarbamide. By SIMEON M. TANATAR (*Zeit. physikal. Chem.*, 1896, **19**, 696—698).—The heat of solution is −6·175 Cal.; of neutralisation + 9·277 (18°); + 9·075 (9°); and the heat of solution of the potassium salt is obtained as 10·195. With excess of alkali, the value 9·478 Cal. was obtained on neutralisation, owing probably to a decrease in the dissociation. The heat of decomposition of the potassium salt by hydrogen chloride was + 4·480, the difference in the heats of neutralisation being + 4·463. With excess of acid, however, the value +5·291 was obtained, so that nitrocarbamide has still slightly basic properties.

L. M. J.

Thermochemistry of Hippuric acid, of its Homologues, and of Anisuric acid. By FRIEDRICH C. A. STOHMANN and RAYMUND SCHMIDT (*J. pr. Chem.*, 1896, [2], **53**, 345—369).—It has been previously shown (Abstr., 1894, ii, 340) that the substitution of $CH_2{\cdot}COOH$, for H in an amido-group increases the heat of combustion by 162·7 cal. From this datum and the known heat of combustion of benzamide, the heat of combustion of hippuric acid may be calculated to be 1010·5 cal.; one of the authors previously found it to be 1014·5, and Berthelot and André give 1012·9. The re-determined value is 1012·6. The following table comprises the results of the present investigation. The calculated values are deduced as indicated above. In those cases in which the heat of combustion of the amide is not known, it is deduced from that of the parent acid, for this value has been shown to be smaller than the heat of combustion of the amide by 75·9 cal.

	Heat of combustion at constant pressure.		Heat of formation, cal.	100 *k*.
	Found, cal.	Calculated, cal.		
Hippuric acid, $C_9H_9NO_3$	1012·6	1010·5	143·9	0·0222
Orthotoluric acid, $C_{10}H_{11}NO_3$	1168·2	1168·0	151·3	0·0192
Metatoluric „ $C_{10}H_{11}NO_3$	1167·6	1167·7	151·9	0·0208
Paratoluric „ $C_{10}H_{11}NO_3$	1168·1	1166·0	151·4	0·0199
Benzoylalanine, $C_{10}H_{11}NO_3$	1168·7	1167·1	150·8	0·0194
Benzoylsarcosine, $C_{10}H_{11}NO_3$	1180·9	1177·1	138·6	0·0499
Phenaceturic acid, $C_{10}H_{11}NO_3$	1165·5	1166·2	154·0	0·0203
Orthotoluoylalanine, $C_{11}H_{13}NO_3$....	1322·3	1324·6	160·2	0·0165
Paratoluoylalanine, $C_{11}H_{13}NO_3$.....	1320·0	1322·6	162·5	0·0168
Anisuric acid, $C_{10}H_{11}NO_4$..........	1135·7	1133·8	183·8	0·0161

That the three toluric acids should have virtually identical heats of combustion is contrary to expectation, seeing that an ortho-derivative nearly always has a higher heat of combustion than the corresponding meta-compound has, and that the meta-compound generally shows a higher value than the para-compound. Ortho- and paratoluoylalanine are normal in this respect. It will be noticed that the heats of combustion of corresponding homologues in the above list differ by from 151·9 to 155·6 cal., showing that the approximately regular increase of 156·6 cal. for the addition of CH_2 obtaining in the fatty series (Abstr., 1894, i, 224) is not maintained in the aromatic series.

The entry of a benzoyl group in place of a hydrogen atom in the amido-group raises the heat of combustion by a mean value of 779·6 cal.; similar substitution of a toluoyl group produces a rise of 933·4 cal.

The heat of combustion of phenylacetic acid has been found to be 933·2 cal. This value is not in accord with those found for benzoic acid and phenylpropionic acid, namely 771·7 cal. and 1085·5 cal. respectively; it will be seen that the difference between benzoic acid and phenylacetic acid is 160·5 cal., that between phenylacetic acid and phenylpropionic acids being only 152·2 cal. All analogies indicate that these differences should be more nearly equal than they appear to be. A re-determination, made on a carefully purified specimen of phenylacetic acid, gave 930·7 cal., but this number is believed to be too high, more especially as the value calculated from the heat of combustion of phenaceturic acid is 926·9 cal., and because the conductivity of phenylacetic acid shows it to be a more feeble acid than any of the toluic acids whose heats of combustion range from 929·4 cal. to 927·4 cal. Now the feeblest acid is not likely to have the highest heat of combustion, hence the authors conclude that they have not yet obtained a pure specimen of phenylacetic acid. They adopt the provisional value of 927·6 cal. for the constant in question. A. G. B.

Use of Phenolphthaleïn in illustrating the Dissociating Action of Water. By Harry C. Jones and Charles R. Allen (*Amer. Chem. J.*, 1896, **18**, 377—381).—The authors seek to explain the fact that ammonia will not develop a red colour in an alcoholic solution of phenolphthaleïn until a certain proportion of water has been added, whilst potassium hydroxide will immediately develop a red colour in the alcoholic solution (compare Menschutkin, Abstr., 1883, 550), by reference to the theory of ionic dissociation. They give details of measurements to show that the molecular conductivity of a solution of potassium hydroxide in a mixture of alcohol and water is higher than one of ammonia of corresponding concentration.

A. G. B.

Behaviour of Soap-like Substances in presence of Water. V. By Friedrich Krafft and A. Strutz (*Ber.*, 1896, **29**, 1328—1334).—It has been shown (this vol., i, 80) that the sodium salts of the lower fatty acids raise the boiling point of water by twice the normal value; this was explained by supposing each molecule to be "hydrolytically decomposed" into sodium hydroxide and fatty acid. It was also shown that the sodium salts of the higher fatty acids, when dissolved in water so as to form strong (15—20 per cent.) solutions, do not raise the boiling point of the water at all, whilst the solutions solidify on cooling to gelatinous masses; this behaviour is characteristic of colloïd substances. It is now shown that sodium oleate in *alcoholic* solution does not exhibit this behaviour; it raises the boiling point by about half the normal amount, which may be explained by the existence of double molecules.

Hexadecylamine hydrochloride was next examined, because in a certain sense it is the antipode of such a substance as sodium oleate; if water decomposes it, it will be into an inorganic acid (hydrochloric) and an organic base (hexadecylamine) of high molecular weight, whereas sodium oleate is decomposed into an inorganic base (sodium hydroxide) and an organic acid (oleic) of high molecular weight. As a matter of fact, it was found to exhibit, in aqueous solution, the behaviour of a colloïd substance; in alcoholic solution, it caused a normal rise in the boiling point. Further, just as the lower "soaps,"—sodium acetate, for example—behaved like crystalloïds in alcoholic solution, and, owing to their "hydrolytic decomposition," gave only half the normal rise of boiling point, so the lower amine hydrochlorides,—methylamine hydrochloride, and also ammonium chloride itself,—were found to exhibit precisely the same behaviour; it is assumed that they were decomposed into hydrochloric acid and amine (ammonia).

Lastly, hexadecylamine palmitate, a compound of an organic amine with an organic acid, both of high molecular weight, was examined. Even in dilute solution (2½ per cent.) it exhibited the behaviour of a colloïd substance.

It will be noticed that the term "hydrolytic decomposition" is not used in the same sense as by the adherents of the electrolytic dissociation theory. It may also be remarked that there is no discussion in the paper of the possibility that it is by virtue of their dissociation into ions that sodium acetate, methylamine hydrochloride, &c., raise the boiling point of water by twice the normal amount. C. F. B.

A Theory of Colloïdal Solutions. By FRIEDRICH KRAFFT (*Ber.*, 1896, **29**, 1334—1344; compare this vol., i, 80, and preceding abstract).—The following two laws are enunciated.

I. *Colloïdal Liquids or Solutions contain the Liquefied Substance in the Molecular State.*—By "molecular state" is meant, presumably, in the state of single molecules, and not in that of molecular aggregates. The sodium salts of the lower fatty acids exist in the "molecular state" in aqueous solution; and they give twice the normal rise of boiling point, which corresponds with a "hydrolytic decomposition" into sodium hydroxide and the fatty acid. Now the sodium salts of the higher fatty acids, which have been shown to behave as colloïds, yield dilute aqueous solutions which begin to crystallise at temperatures only slightly below the solidifying points of the corresponding acids themselves. And a strong (15—20 per cent.) aqueous solution of sodium stearate has even been found to solidify (to a gelatinous mass) at the same temperature as that at which stearic acid itself solidifies or melts. (The free salts, it may be said, do not melt or decompose until about 250°.) It would seem thus that the sodium salts of the higher fatty acids, like those of the lower, are decomposed in aqueous solution, colloïds though they be, into sodium hydroxide and fatty acid. Now palmitic acid, dissolved in ether, lowers the boiling point by the normal amount, and therefore must exist as single molecules at temperatures as low as that of boiling ether. From these facts the conclusion is drawn that "colloïdal soap solutions contain the dissolved soaps in the molecular state."

II. *Colloïdally Liquefied Molecules rotate in very small Closed Orbits or Surfaces.*—The molecules of crystalloïds in solution are regarded as having a motion similar to that of gaseous molecules; their motion of translation gives rise to osmotic pressure and the accompanying phenomena of lowering of freezing point and raising of boiling point. Now it has been shown that the distinction between colloïd and crystalloïd substances does not consist in a difference of molecular aggregation. This distinction manifests itself in an absence of influence on the boiling point of the solvent, from which we may infer an absence of appreciable motion of translation; the motion of the molecules of dissolved colloïd substances is, therefore, one of rotation. It is further suggested that the structural unit, so to speak, of a colloïdal solution is a "proto-cellular bubble" of extremely small dimensions, the surface of the bubble being formed by molecules of the dissolved colloïd, whilst the interior is filled with the solvent. In this connection, it is interesting to note that bubbles of a solution of a colloïd substance can be blown, and can exist, only at temperatures approaching, to or above, that at which the colloïd solution begins to be formed; that is, above the temperature at which the colloïd solution gelatinises when it is cooled. In this respect, hexadecylamine hydrochloride behaves like sodium stearate. If we assume that "proto-cellular bubbles" are also the structural units of organised substances, it is thus easy to understand why a certain minimum temperature is essential to the life of organised beings. C. F. B.

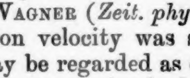
Solid Solutions formed by Non-isomorphous Substances. By FELICE GARELLI (*Gazzetta*, 1896, **26**, i, 61—88).—The author has previously shown (Abstr., 1894, i, 157) that many substances give anomalous results by the cryoscopic method, owing to a tendency which they have to form solid solutions with the solvent employed; this is due, in most cases, to isomorphism between the dissolved substance and the solvent. It is now shown from crystallographic data compiled by Negri that isomorphism will not account for all cases of anomalous depression of the freezing point. Benzoic acid is not isomorphous with its hydroxy- or amido-derivatives, and the crystallographic relationship between benzoic acid on the one hand, and para- and ortho-hydroxybenzoic acids on the other, are almost the same; paramidobenzoic acid is crystallographically much more like benzoic acid than is its ortho-isomeride, although the behaviour of para-derivatives in benzoic acid solution is more nearly normal than that of the ortho-compounds. Similarly there is a close crystallographic analogy between benzoic acid and the pyromucic and pyrrolinecarboxylic acids, although only the latter behaves abnormally in freezing benzoic acid. On the other hand, succinic and maleïc anhydrides are isomorphous, as would be expected from their cryoscopic behaviour.

The author has further investigated the formation of solid solutions by Bijlert's method, which consists in adding to the solution a third substance which cryoscopically behaves normally; then on analysing the solid separating on cooling the solution, the proportion of the third substance present tells the amount of mother liquor carried down mechanically. The formation of solid solutions of salicylic acid in benzoic acid was thus demonstrated, using diphenylamine or anthracene as the third substance. W. J. P.

"Indirect" Etherification. By Julius Tafel (*Zeit. physikal. Chem.*, 1896, **19**, 592—598).—The author considers that Peterssen's indirect etherification (Abstr., 1895, ii, 258) is due, not to the action of the methylic chloride, but to the catalytic action of hydrogen chloride. His experiments show that the accelerative influence of pure methylic chloride is very small compared with that of the acid. Thus the ratios k/k_0 of the velocity constants in the presence and absence (1) of methylic chloride, and (2) of hydrogen chloride of equal chlorine content, are respectively 3 and 1410. The ratio k/k_0 is, however, not proportional to the quantity of acid. L. M. J.

The Catalytic Action of Hydrogen Ions in Polymolecular Reactions. By Arthur A. Noyes (*Zeit. physikal. Chem.*, 1896, **19**, 599—606).—According to Magnanini's observations, the accelerative effect of acids on the velocity of the reaction between bromic and hydriodic acids increases more rapidly than the concentration of the added acid (Abstr., 1892, 110). The reaction was shown by the author to be of the second order (this vol., ii, 158), and from Magnanini's numbers he proves that the velocity is proportional to the square of the concentration of the acid. In the case of the reaction between hydrogen peroxide and hydrogen iodide, the increase of the velocity is proportional to the added acid. From this, it appears as if the acceleration were due to an increased activity of the reacting compounds; in the latter case, the activity of one of the compounds only being increased. In the case of the reaction between ferric chloride and stannous chloride, a reaction of the third order (Abstr., 1895, ii, 257), the acceleration, as deduced from Kahlenberg's experiments (Abstr., 1894, ii, 346), appears also to be proportional to the square of the concentration. L. M. J.

Decomposition Velocity of Acids containing both Sulphur and Nitrogen. By Max Wagner (*Zeit. physikal. Chem.*, 1896, **19**, 668—688).—The decomposition velocity was studied in the cases of a number of acids which may be regarded as derived from ammonia by the displacement of the hydrogen by hydroxyl and sulphonic acid groups. The decomposition was usually effected by the action of dilute acids on the aqueous solution of the acid or its potassium salt. Measurements of the velocity were obtained in the cases of imidosulphonic acid, $NH(SO_3H)_2$; nitrogen trisulphonic acid, $N(SO_3H)_3$; nitrosohydroxylaminesulphonic acid, $NO\cdot N(OH)\cdot SO_3H$; hydroxylaminedisulphonic acid, $OH\cdot N(SO_3H)_2$; sulphazotic acid, $O_2[NH(SO_3H)_2]_2$; oxysulphazotic acid, $2NO(SO_3H)_2$; and nitrotrisulphonic acid,



$$O_2{<}\begin{array}{l}N(SO_3H)_2\\ \mid\\ N(SO_3H)_2\end{array};$$

whilst other acids were examined without, however, measurements of the velocity being obtainable. Determinations were also obtained with the phenyl-, tolyl- (ortho-, meta-, and para-); xylyl- (ortho-, meta-, and para-); chlorophenyl- (ortho-, meta-, and para-); and β-naphthylsulphamic acids. The entrance of the hydrocarbon groups is found to increase the velocity of decomposition. In this respect the more complex groups exert a greater influence than the phenyl group, except in the case of the meta- and para-tolylsulphamic acids, whilst the velocity becomes practically zero for the nitro- and methylphenyl-compounds, and infinite for the β-naphthyl acid.

L. M. J.

Analytical Representation of the Periodic System of the Elements. By DMITRI A. GOLDHAMMER (*Zeit. anorg. Chem.*, 1896, **12**, 39—45).—If the chemical character of an element of atomic weight p is denoted by e, then $e = F(p)$ is the equation to a periodic curve. If further the value of e at certain points passes through $\pm\infty$, the curve will consist of a number of separate portions, each of which will represent a distinct period. These portions will be in no way identical, although similar in form.

Flavitzky and Thomsen have independently suggested the cotangent as fulfilling the required properties of the function; but the author regards it as more probable that the function is of a more complex order.

H. C.

Inorganic Chemistry.

Density of Hydrogen and Oxygen. By JULIUS THOMSEN (*Zeit. anorg. Chem.*, 1896, **12**, 1—15; see also this vol., ii, 244).—The density is obtained by determining the volume of a known weight of the gas in a similar manner to that in which the ratio of the atomic weights was determined. A full description of the apparatus employed is given in the original paper. The volume of the weight of hydrogen evolved from the dissolution of a known weight of aluminium in a solution of potassium hydroxide was determined, and the volume of the weight of oxygen evolved by heating a mixture of 4 parts of fused potassium chlorate, 3 parts of compact ferric oxide, and 3 parts of porous ferric oxide.

The results obtained, calculated for latitude 45° at 0° and 760 mm., are as follows. Weight of 1 litre of hydrogen, 0·089947 gram; weight of 1 litre of oxygen, 1·42906 gram; ratio of the densities, 1 : 15·8878; ratio of the atomic weights, 1 : 15·8690; ratio of the volumes in the formation of water, 1 : 2·00237; volume of 1 gram of hydrogen, 11·1176 litres; volume of 1 gram of oxygen, 0·69976 litres.

E. C. R.

Decomposition of Silver Oxide by means of Hydrogen Peroxide. By E. RIEGLER (*Chem. Centr.*, 1895, ii, 545; from *Bull. Soc. Sci. Fiz., Bukarest*, **4**, 78—80).—At one time it was generally believed that the reaction between silver oxide and hydrogen peroxide was represented by the equation $Ag_2O + H_2O_2 = Ag_2 + H_2O + O_2$, until Berthelot substituted for this $2H_2O_2 + 4Ag_2O = 2H_2O + 2Ag_2 + 2Ag_2O + O_2$.

After carefully going into the matter, the author now states that neither of these equations is correct, but that they must be replaced by the following ones: $3H_2O_2 + 2Ag_2O = 3H_2O + Ag_4O + 2O_2$; $Ag_4O = Ag_2 + Ag_2O$. L. DE K.

New Electrolytic Method. By THEODOR GROSS (*Chem. Centr.*, 1895, i, 411—412; from *Electrochem. Zeits.*, 1894, **1**, 80—84).—By the electrolysis of a solution containing 1 part of silver sulphate, 2—3 parts of silver oxide, and 120 parts of a 10 per cent. solution of ammonia, using mercury electrodes containing silver, the author obtains the separation at the anode of a grey mass, which is coloured white when heated with nitric acid, loses mercury when heated alone, and leaves a brownish-yellow, fusible residue. This residue appears to contain an entirely new substance, which the author regards as a decomposition product of the sulphur contained in the silver sulphate. After removal of the mercury and silver present, a dull grey powder is obtained which is insoluble in nitric acid, and dissolves in aqua regia to a yellow liquid, giving with hydrogen sulphide in the slightly acid solution a brown precipitate somewhat soluble in ammonium sulphide. This brown precipitate when heated, loses sulphur, and the original grey powder is recovered. H. C.

Action of Hydrogen Bromide and Hydrogen Iodide on Phosphorus Oxychloride. By ADOLPHE BESSON (*Compt. rend.*, 1896, **122**, 814—817).—Dry hydrogen bromide has no action on phosphorus oxychloride at its boiling point, but if the gas is dissolved in the liquid and heated in sealed tubes at 200°, decomposition takes place. The best results are obtained by passing a mixture of gaseous hydrogen bromide and vapour of the oxychloride through a tube filled with pumice and heated at 400—500°. Under these conditions there is complete displacement of oxygen and chlorine by bromine, and the product contains phosphorus pentabromide. Other constituents of the product are $POCl_2Br$, $POClBr_2$, and $POBr_3$.

Phosphorus oxydichlorobromide, $POCl_2Br$, shows great tendency to remain in superfusion, but forms large, colourless lamellæ which melt at 13°; it boils at 135—138°. The *oxydibromochloride*, $POClBr_2$, shows a similar tendency; it melts at 30° and boils at 165°; sp. gr. = 2·45 at 50°. When boiled in contact with air, the bromine is partially displaced by oxygen, and the product contains $POCl_3$, $POCl_2Br$, and $POBr_3$. In a sealed tube, the final products are $POCl_3$ and $POBr_3$, the intermediate oxydichlorobromide, $POCl_2Br$, being decomposed by heat.

Hydrogen bromide acts energetically on phosphorus trichloride, but the product always splits up into the trichloride and the tribromide. If chlorobromides are formed, it would seem that they can only be separated by fractional solidification or melting.

Hydrogen iodide acts rapidly on phosphorus oxychloride at the ordinary temperature, with liberation of iodine, but at 0° the action is slower, and the product contains iodine, phosphorus triiodide, and metaphosphoric acid. There is some evidence that a crystallisable yellow phosphorus oxyiodide is also formed in small quantity, but it could not be definitely isolated. C. H. B.

Thiophosphates. By LUCIEN FERRAND (*Compt. rend.*, 1896, **122**, 886—889).—The author has prepared by Friedel's method a second series of thiophosphorus compounds which he terms *thiopyrophosphates*. Their general formula is $M'_4P_2S_7$ (compare Abstr., 1895, ii, 389). The *cuprous* compound is a violet, crystalline compound, attacked by alkalis and acids with the exception of hydrochloric acid; no cupric compound could be obtained. The *ferrous* compound forms small, lustrous lamellæ, insoluble in cold nitric acid; the *silver* compound is a yellow, crystalline mass not attacked by boiling nitric acid, but decomposed by aqua regia; the *nickel* compound is a deep brown, crystalline powder, attacked by nitric acid at 150°; the *chromous* compound crystallises in minute, black, hexagonal lamellæ; the *zinc* compound in small needles; the *cadmium* compound is white and crystalline, and but slightly attacked by acids; the *mercurous* compound is red and crystalline, and is not attacked by acids; the *lead* compound is red and crystalline, and is decomposed by hot nitric acid; the *aluminium* compound crystallises in small, white needles, and is very readily attacked by water, alkalis, and acids. The mercurous, zinc, cadmium, chromium, and nickel compounds are decomposed by water or moist air, although some of them offer considerable resistance to the action of acids. C. H. B.

Sulphoxyarsenates [Thioarsenates]. By R. F. WEINLAND and O. RUMPF (*Ber.*, 1896, **29**, 1008—1012).—By boiling aqueous sodium arsenite with the calculated quantity of precipitated sulphur, *sodium monothioarsenate*, $Na_3AsSO_3,12H_2O$, can be obtained. The *potassium* salt can be prepared in the same way, but it is hygroscopic, and difficult to purify. To obtain the *ammonium* salt, $(NH_4)_3AsSO_3,3H_2O$, the digestion has to be conducted under pressure; the salt rapidly loses ammonia when left exposed to the air.

Selenium behaves in a similar way, the compound,

$$Na_3AsSeO_3,12H_2O,$$

being formed. Tellurium also adds itself on to some extent; the product obtained had a composition approximating to $Na_{12}As_4TeO_{15}$.

Monopotassium monothioarsenate, KH_2AsSO_3, is best prepared by the action of salicylic acid on the tripotassium salt; by dissolving it in aqueous potassium hydroxide, the *dipotassium* salt can be obtained; this is very hygroscopic, and was not got pure.

Sodium dithioarsenate, $Na_3AsS_2O_2$, can be obtained in various ways, as by the addition of sodium bisulphide to sodium metarsenite, or by the action of sodium bisulphide on sodium orthoarsenite or monothioarsenate, other products being simultaneously formed. It has not been found possible, hitherto, to prepare a trithioarsenate, Na_3AsS_3O.

C. F. B.

Calcium Silicide. By GUILLAME DE CHALMOT (*Amer. Chem. J.*, 1896, **18**, 319—321).—If silica, lime, and carbon, mixed in the proportions theoretically necessary for the production of calcium silicide, are fused in the electric furnace, calcium carbide is the main product, but is accompanied by silicide; when the silica is in excess, an impure calcium silicide is formed, but is contaminated with considerable quantities of calcium carbide, silicon, and iron derived from the furnace. Specimens of the product vary considerably in appearance, but are all sufficiently hard to scratch glass, and show the reactions for calcium silicide described by Wöhler. They evolve hydrogen when placed in water, and in dilute hydrochloric acid form a yellow silicic acid; if in the latter instance the silicide be finely divided, hydrogen silicide is evolved. When boiled with hydrochloric acid, the silicide is decomposed, and crystals of silicon remain.

Calcium carbide, when fused with sand, forms a small quantity of calcium silicide. A. L.

Basic Magnesium Nitrate. By GASTON DIDIER (*Compt. rend.*, 1896, **122**, 935—936).—Two hundred grams of hydrated, normal magnesium nitrate was dissolved in 150 c.c. of water, and to this solution, heated at 100°, was added in successive small quantities, 10 grams of magnesium oxide prepared by heating the basic carbonate at a temperature between 350° and 400° for several hours. Towards the end of the operation the liquid is heated to 150°, filtered through cloth, and allowed to remain for some time in closed vessels. After some days, a flocculent precipitate begins to form, and slowly increases and fills the whole vessel. When dried out of contact with carbonic anhydride, the product consists of slender, white, microscopic, optically active needles, of the composition $3MgO,N_2O_5,5H_2O$. Water decomposes it completely into its proximate constituents and absolute alcohol has a similar effect. C. H. B.

Recent Work on Double Haloïds. By CHARLES H. HERTY (*Amer. Chem. J.*, 1896, **18**, 290—294; compare Abstr., 1895, ii, 112). —Lenher (*J. Amer. Chem. Soc.*, 1895, **17**, 511) has given no proof of the existence of the compounds $PbI_2,2KI$ and $PbI_2,4KI$, described by him as occurring in solution. The compound, $3PbI_2,4KI$, described by Mosnier (Abstr., 1895, ii, 268) has repeatedly been shown to be incapable of existence, whilst those to which he assigned the formulæ $3PbI_2,4NH_4I$ and $PbI_2,2NaI$, are found on examination to be mixtures containing ammonium or sodium iodide.

The salt described by Miss Field (Trans., 1893, 540) proves, on analysis, to have the composition $NH_4I,PbI_2 + 2H_2O$, and not $3PbI_2,4NH_4I$, as stated by that author, and analyses of the compounds $PbICl$ and $PbI_2,3PbCl_2$ confirm the suggestion of Retgers (Abstr., 1895, ii, 309) that they are merely isomorphous mixtures.

A. L.

Relations between Copper and Concentrated Sulphuric acid. By CHARLES BASKERVILLE (*J. Amer. Chem. Soc.*, 1895, **17**, 904—912).—The author has made a number of experiments showing the action of sulphuric acid on metallic copper at different temperatures, and tabulated the results.

The experiments were made in a current of carbonic anhydride so as to exclude the air. The insoluble black substance seems to be copper sulphide, but in one experiment an oxysulphide of the formula $CuO,2Cu_2S$ was obtained. On the whole, the experiments, particularly those concerning the secondary reactions, confirm those of Pickering (Trans., 1878, 112). L. DE K.

Rare Earths in Monazite Sands. By PAUL SCHÜTZENBERGER and O. BOUDOUARD (*Compt. rend.*, 1896, **122**, 697—699).—The metals in monazite sands which form sulphates soluble in a saturated solution of potassium sulphate, comprise metals of the yttrium group with a mean atomic weight of 105—106, and also a metal forming a colourless oxide, the equivalent of which is not altered by fractionation of either the nitrate or the sulphate; its atomic weight is very nearly 102 (101·95—102·4). C. H. B.

New Element in Rare Earths of the Samarium Group. By EUGÈNE A. DEMARÇAY (*Compt. rend.*, 1896, **122**, 728—730).—Fractionation by crystallisation from concentrated nitric acid of earths very rich in samarium yielded a new nitrate more soluble in nitric acid than that of gadolinium but less soluble than that of samarium. The corresponding oxide differs from terbia in being colourless, and its salts are colourless, and show no absorption spectra. Its spark spectrum differs from those of lanthanum, cerium, gadolinium, ytterbium, and terbium. The new oxide, Σ_2O_3, differs from lanthanum and cerium oxides by its relatively feeble basicity and the greater solubility of its double potassium sulphate; from ytterbia by its greater basicity and the lower solubility of its double sulphate. In both respects it resembles gadolinium and samarium, but gives a different spectrum.

The most characteristic lines in the spectrum of the new element Σ are 4228·1, 4205·9, 4128·4, 3972·2, 3930·8, 3819·9, whilst the most characteristic of gadolinium are 4263·1, 4178·2, 4098·6, 4063·4, 4049·9, 3959·9, 3958·1, 3916·7, 3852·6, 3850·9, 3549·3, 3545·7. None of either group can be attributed to terbium. Some samarium carefully purified by Clève was found to contain a very considerable proportion of the new element, and it seems probable that the true atomic weight of samarium is considerably below the value (150) now attributed to it. C. H. B.

Reduction of Permanganic acid by Manganese Dioxide. By HARMON N. MORSE, A. J. HOPKINS, and M. S. WALKER (*Amer. Chem. J.*, 1896, **18**, 401—419).—The authors summarise their work as follows. (1) Permanganic acid and potassium permanganate are reduced by precipitated manganese dioxide with liberation of three-fifths of the active oxygen of the permanganic acid; (2) standard solutions of permanganate should be filtered through asbestos; (3) such filtered solutions exhibit a high degree of stability, whether kept in darkness or in diffused light; even pure solutions are, however, decomposed in direct sunlight; (4) the oxide produced by the complete reduction of a neutral solution of potassium permanganate contains all the potassium of the original salt, and the supernatent liquid is therefore neutral; (5) whether the precipitated manganese oxide is formed by the slow decomposition of a neutral solution of potassium permanganate or by the addition of manganese sulphate to an acidified solution of permanganic acid (*sic*), the ratio of oxygen to manganese in it remains normal (that is, 2 : 1) only so long as unreduced permanganate or permanganic acid is present, otherwise the oxide loses oxygen even at the ordinary temperature. In the presence of permanganate, the lost oxygen is restored. A. G. B.

Crystallised Iron Sesquiphosphide. By A. GRANGER (*Compt. rend.*, 1896, **122**, 936—937).—Iron sesquiphosphide, Fe_2P_3, is obtained as a pale grey mass of hard, lustrous, non-magnetic, microscopic crystals by heating ferric chloride to dull redness in phosphorus vapour. The two substances are placed in separate dishes in the same tube, and the phosphorus vapour is carried over the iron salt by means of a current of carbonic anhydride.

The sesquiphosphide is insoluble in hydrochloric and nitric acids and in aqua regia; does not alter when heated in air to dull redness, but loses phosphorus at a bright red heat; and is slowly attacked by chlorine at dull redness, and by bromine at a higher temperature.

C. H. B.

Molybdenum Amalgam and some Properties of Molybdenum. By JULES FÉRÉE (*Compt. rend.*, 1896, **122**, 733—735).—Hydrochloric acid of 22° B. saturated with molybdic acid is diluted with nine times its volume of water, and electrolysed with a mercury cathode and a platinum anode, the current being about 5 ampères for each sq. cm. of mercury surface. After some time, the mercury is dried and filtered through chamois leather, when it yields a solid amalgam, $MoHg_9$, which is but slightly affected by moist air. When it is subjected to a pressure of 200 kilos. per sq. cm., it yields another amalgam, $MoHg_2$, and if this is broken up and again compressed, it yields a third compound, Mo_2Hg_3, which alters rapidly in moist air. The decomposition of the amalgams under pressure is the inverse of the phenomena observed by Spring.

The molybdenum obtained from the amalgam by distillation in a vacuum at a low temperature is pyrophoric, but loses this property if heated above 400°. It absorbs sulphurous anhydride completely, becoming incandescent, and yielding a mixture of molybdenum sulphide and oxides. Nitrogen, carbonic anhydride, and hydrogen sulphide are without action, even when gently heated. Carbonic oxide is, however, rapidly decomposed with liberation of carbon and formation of molybdenum oxides. Nitric oxide is completely absorbed with incandescence, a mixture of molybdenum oxides and a nitride being formed. C. H. B.

A new Perthiomolybdic acid. By KARL A. HOFMANN (*Zeit. anorg. Chem.*, 1896, **12**, 55—62).—The *ammonium salt*, MoS_6NH_4,H_2O, is obtained as follows. A solution of ammonium molybdate,

$$(NH_4)_6Mo_7O_{24},4H_2O,$$

(20 grams) in water (260 c.c.) is mixed with 7 per cent. ammonia (20 c.c.) and treated for four hours with hydrogen sulphide, whereby a solution of ammonium thiomolybdate, $(NH_4)_2MoS_4$, is obtained. This solution is mixed with a solution of ammonium polysulphide and allowed to remain 24 hours, when the salt separates in lustrous, black needles; a further quantity of the salt is obtained by carefully precipitating the mother liquors with alcohol. It is purified by washing with

water, then with alcohol, ether, and carbon bisulphide, finally drying over potassium hydroxide. It dissolves sparingly in water and alcohol with a yellowish-brown coloration. The *potassium salt*, MoS_6K, obtained by treating the ammonium salt with 10 per cent. potassium hydroxide for 24 hours at the ordinary temperature, crystallises in thin, dark brown leaflets, and is more soluble in water than the ammonium salt. The *cæsium salt* crystallises in long, black needles, and is insoluble in water, the *thallium salt* in lustrous, black prisms, insoluble in water. The *free acid*, MoS_6H, is obtained by treating the ammonium salt with cold 10 per cent. hydrochloric acid, and then washing the product with carbon bisulphide.

When the above ammonium salt is warmed with a solution of potassium hydrosulphide in a current of hydrogen, it is converted into the pentathiomolybdate described by Krüss.

E. C. R.

Physical Properties of Phosphododecatungstic acid. By M. Soboleff (*Zeit. anorg. Chem.*, 1896, **12**, 16—38).—*Phosphododecatungstic acid*, $H_3PO_4,12WO_3,21H_2O$, sp. gr. 4·68. Both the acid and its salts are easily soluble in water, and the solution shows the reactions of phosphoric and metatungstic acids, and gives precipitates with alkaloïds and peptones. The free acid is also soluble in ether and alcohol. When ether is added to an aqueous solution of the acid, heat is developed and three layers are formed, the top one is a layer of ether, the middle one a solution of the acid in water, and the bottom one a solution of the acid in ether. The acid, when partially dehydrated, can only be dissolved in ether when water, corresponding with the amount of dehydration, is added. There are two hydrates of the crystallised acid. The supersaturated solution, when quickly cooled, gives skeleton crystals belonging to the regular system, and then well-formed cubes and octahedra; the last form is the most stable, and is always obtained on cooling saturated solutions or by prolonged crystallisation in a desiccator. When these octahedra are separated from the solution they quickly become covered with six-sided stars, arranged parallel to the edges of the octahedron, and the crystals break up into new crystals which contain less water. The crystals of the second hydrate are obtained by crystallising a supersaturated solution in a thermostat at 50°. It crystallises in the rhombic system, $a : b : c = 0·94207 : 1 : 1·96187$. When the solution is quickly evaporated, long, thin needles are obtained, which act on polarised light. The *barium salt* crystallises in regular octahedra; the *sodium salt* in regular octahedra, sp. gr. 4·73; these are very unstable and give up their water of crystallisation on exposure to the air. Concentrated solutions, when crystallised in a thermostat at 80°, give crystals of a second hydrate, which crystallises in the triclinic system, $a : b : c = 1·08752 : 1 : 2·08137$. $\alpha = 85° 21' 0''$, $\beta = 95° 27' 54''$, $\gamma = 87° 41' 30''$. The above crystallographic data and the conversion of one form into the other without influencing the composition of the compound, is not in accordance with the behaviour of an isomorphous mixture.

The formation of the complex acid and its salts is analogous to the formation of metatungstic acid. A few reactions and the power of forming precipitates with peptones and organic bases are common to both acids, they are also similar in crystalline form and in possessing an intensely bitter and strongly acid taste; the complex acid, however, is not affected by temperature or by mineral acids, and can be boiled with strong acids without decomposition. By prolonged dialysis of the complex acid, the phosphoric acid can be completely separated from the tungstic acid compound. The complex acid is partially dissociated in solution, and the phosphoric acid then passes through the membrane much more easily than the metatungstic acid.

The saturated solution of sodium metatungstate crystallises in skeleton forms which combine to form octahedra; sp. gr. = 4·04. At first the crystals have no action on polarised light, but they soon show cleavage lines and become optically active. The *barium* salt crystallises in the orthorhombic system, and is totally unlike the salt of the complex acid. Metatungstic acid dissolves in ether, and the solution has the same behaviour as that of the complex acid.

Metatungstic acid, $H_2O(WO_3)_4,9H_2O$, has sp. gr. = 3·93. When heated at 50°, it is decomposed, and is no longer soluble in water; below 180° it is anhydrous. Phosphododecatungstic acid is not decomposed at 200°, and becomes anhydrous only at a red heat. Its stability and also its specific gravity is evidence for the complex character of the condensed compound.

The solubility of the acids and salts in water and ether and the specific gravities of the aqueous solutions are given, and also details of experiments on the lowering of the freezing points and raising of the boiling points of the solutions; the depression due to the condensed acid is much smaller than the sum of the depressions of its components. At the higher concentrations, the difference of the depressions for 1 gram of the complex acid is constant, at lower concentrations it is much smaller, this being due to the dissociation of the complex acid. The electrical conductivity of the complex acid is smaller than that of its components.

The author concludes that phosphododecatungstic acid is neither an isomorphous mixture nor a double salt, but must be considered as a complex acid. E. C. R.

Chlorides of Zirconium. By FRANK P. VENABLE (*J. Amer. Chem. Soc.*, 1895, **17**, 842—843).—The author had made repeated estimations of zirconium in the salt obtained by dissolving the hydroxide in hydrochloric acid, and recrystallising from the strong acid, with results that left no doubt that the compound was the pure tetrachloride; but having lately made some determinations of the chlorine as well, it now appears that Bailey was right in calling it an oxychloride. The probable formula is $Zr_3(OH)_5Cl_7 + 5H_2O$.

L. DE K.

Action of Reducing Agents on the Nitroso-compounds of Ruthenium. By L. BRIZARD (*Compt. rend.*, 1896, **122**, 730—732).—When the nitrosochloride, $RuNOCl_3,2KCl$, is reduced by formaldehyde in presence of excess of alkali at 60°, it yields a black precipitate and a brown liquid, and when the latter is neutralised with hydrochloric acid, a brown precipitate separates consisting of oxides resulting from reduction of the nitrosochloride. When this precipitate is dissolved in hydrochloric acid, and the solution is concentrated, it yields small, red, optically active crystals which are readily separated from the accompanying chloride, $Ru_2Cl_6,4KCl$, because they dissolve very slowly in cold water. The red crystals have the composition $Ru_2(NO)H_4Cl_5,3KCl$, and contain no water of hydration, but probably have the constitution $2HCl,Ru(NO)H_2 \cdot RuCl_3,3KCl$. With potassium hydroxide, they yield a pale brown precipitate, and 3 mols. of the hydroxide completely precipitate 1 mol. of the salt. The precipitate has the composition $NO \cdot Ru_2H_2Cl_2 \cdot OH + 2H_2O$. Ammonia has no effect on the solution of the red crystals in the cold, but, on heating, the liquid becomes pale yellow, and deposits a crystalline, yellow powder as it cools. Chlorine water converts the red salt into the original chloride, $Ru(NO)Cl_3,2KCl$, and when the red crystals are heated in hydrogen, a considerable quantity of ammonium chloride volatilises.

Stannous chloride reduces the nitrosochloride, and yields red crystals analogous in composition to the compound already described, but containing tin instead of potassium.

Ammonia reduces potassium rutheniate in the cold, and by the same method of subsequent treatment the same product is obtained as with formaldehyde. This reduction is analogous to the formation of potassium osmiamate by the action of ammonia on the osmate.

C. H. B.

Mineralogical Chemistry.

Alteration Products of Blende. By Giuseppe Cesàro (*Ann. Soc. Géol. Belgique*, 1895, **22**, 217—224).—The transparent blende of Picos de Europa, Spain, is corroded and altered in places, presumably by the action of water containing carbonic anhydride. The soft, dull white, fibrous or amorphous material, after being dried at 100°, was analysed (I); the results correspond with the formula $2ZnO,CO_2,H_2O$ or $ZnCO_3,Zn(OH)_2$, analogous to malachite: hydrozincite is usually given as $ZnCO_3,2Zn(OH)_2$, but the analyses vary.

	ZnO.	CO_2.	H_2O.	Total.
I.	72·15	19·77	8·08	100·00
II.	65·47	33·63	—	99·10

In the interior of the last substance, but never in contact with the unaltered blende, are kernels of a white, crystalline substance, with saccharoidal texture, and H = 5; the results of analysis are given under II, agreeing with $ZnCO_3$.

The corrosion figures are described in detail, and the low degree of symmetry shown by them is discussed. L. J. S.

Ochres. By Gustav Gin (*Compt. rend. Assoc. franç. Adv. Sci.*, 1895, **23** (1894), ii, 512—527).—The ochres are classed as yellow, red, and brown, the colour in each case being due to limonite, earthy hæmatite, and a mixture of pyrolusite and ferric oxide respectively. Several analyses are given. Some ochres contain, in the clayey base, as little as 2—4 per cent. of ferric oxide, but generally only those with 9—10 per cent., or more, are of commercial value. The mode of occurrence and origin of ochres are described, as well as the methods of examining commercial samples. L. J. S.

Analyses of Argentine Minerals, &c. By FREDERICO SHICKENDANTZ (*Rev. Museo La Plata*, 1895, **7**, 1—12).—Several analyses are given of soils, and of the impure material of salt deposits; many of the latter showing much sodium chloride, with sometimes sulphate and borate. The following are of interest: I. Salt from the Rio Negro district. [? Thenardite.] II. Yellow, friable sulphate, soluble in water; from east of Candado, prov. Catamarca. Also a trace of copper. [? Ihleite.] III. White salt from the volcano of Antofagasta, prov. Catamarca. [? Mendozite.] IV. Yellow salt, from the same locality as III.

	SO_3.	Na_2O.	Fe_2O_3.	Al_2O_3.	MgO.	H_2O.	Residue.	Total.
I.	54·00	43·93	—	—	—	0·86	0·48	99·27
II.	39·46	—	22·82	—	1·46	35·00	0·80	99·54
III.	37·19	4·62	—	15·49	—	38·60	4·60	100·50
IV.	34·93	little	14·99	—	—	43·44	5·87	99·23

L. J. S.

Basic Sulphate of Iron from Mount Morgan, Queensland. By THOMAS COOKSEY (*Records Australian Museum*, 1896, **2**, 111—112).—This occurs as dull, compact, brown nodules in a matrix of iron oxide; the powder is yellow and crystalline. No water is given off below 175°; analysis gave

Fe_2O_3.	Na_2O.	K_2O.	SO_3.	H_2O.	Total.	Sp. gr.
49·13	4·43	3·88	33·31	9·96	100·71	3·107

The substance differs from jarosite in the proportion of potassium and sodium, and in being almost insoluble in water. L. J. S.

An Artificial Hydrated Magnesium Silicate. By LUCIEN L. DE KONINCK (*Ann. Soc. Géol. Belgique*, 1895, **22**, 67—71).—The white, flaky, unctuous material, resembling powdered talc, which is formed by the action of magnesia solution (ammoniacal solution of magnesium and ammonium chlorides) on the glass of reagent bottles, gave, on analysis,

H_2O.	SiO_2.	MgO.	Al_2O_3. Fe_2O_3 (trace).	Total.
31·29	32·99	34·80	0·87	99·95

Calculating the alumina with the magnesia, the formula $18MgO,11SiO_2,35H_2O$ is deduced, or if the alumina be neglected, $3MgO,2SiO_2,6H_2O$.

At 100°, about 17 per cent. of water (corresponding with $15H_2O$ in the first formula) is lost, which is reabsorbed from moist air. The material has no action on polarised light. With different samples of glass, the substance formed had always the same amount of water. The composition is compared with talc, $3MgO,4SiO_2,4H_2O$, and serpentine, $3MgO,2SiO_2,2H_2O$.

It is suggested that serpentine and dolomite may have had their origin in the action of magnesia solutions on siliceous and calcareous rocks. (Compare this vol., ii, 116.) L. J. S.

A Silicate probably belonging to a New Mineral Species. By GIUSEPPE CESÀRO (*Bull. Acad. Belg.*, 1895, [3], **29**, 508—510).—Along with the hexagonite of Edwards, St. Lawrence Co., N.Y., a colourless, or slightly rosy, opaline mineral of hardness 4·5 occurs; it is orthorhombic, with two cleavages parallel to planes of symmetry. Perpendicular to the better cleavage is an acute, negative bisectrix, with $2E = 83° 30'$, the plane of the optic axis being parallel to the other cleavage. It is a silicate of magnesium with manganese and calcium, but contains neither iron nor aluminium. It is not attacked by acids; after the action of alkali carbonates, it leaves a residue of about 58 per cent., insoluble in acids. It is easily fusible. It differs from enstatite and anthophyllite. L. J. S.

Zeolites and the Substitution of various Substances for the Water which they contain. By GEORGES FRIEDEL (*Compt. rend.*, 1896, **122**, 948—951; compare following abstracts).—When analcite is heated so that it loses water, it retains its original form and the refractive power is increased. At the ordinary temperature, the dehydrated mineral does not reabsorb water, but at about 100° it will reabsorb water from the air and return to its original composition. The tension of dehydration above 100° is of the same order as the pressure of aqueous vapour in the air, and for a given weight of mineral it depends on the area of surface exposed.

When chabazite, harmotome, and similar minerals are slowly heated, they retain their crystalline form, and their refractive power increases, whilst if rapidly heated, the crystals may break up, but the increase in refractive power is still recognisable; the variation in optical properties is proportional to the quantity of water expelled. It is known that these minerals reabsorb water from the air at the ordinary temperature; if, however, after dehydration, they are mixed with a few drops of water, combination takes place with great energy and development of heat, and at the same time a considerable quantity of air is liberated.

The water in the zeolites is not in chemical combination in the common sense of the word, and it can be replaced by various gases, and even by solids such as silica, without alteration in the crystalline form or optical properties of the minerals. Dehydrated chabazite, harmotome, heulandite, and analcite absorb ammonia in large quantity with great energy and development of heat, the quantity absorbed being independent of the nature of the zeolite and proportional to the quantity of water previously expelled. When exposed to moist air, the ammonia is gradually expelled, and its place is taken by water. In the case of analcite the analogy is very close; the ammonia, like water, is not absorbed by the dehydrated mineral below 100°, and it is not displaced by atmospheric moisture at the ordinary temperature.

C. H. B.

A New Artificial Silicate. By Georges Friedel (*Bull. Soc. fran. Min.*, 1896, **19**, 5—14).—This is formed, together with nephelite, when muscovite is heated at 500—530° in a solution (8—10 per cent.) of caustic soda; it is not formed when the temperature is too low, or when the solution is too dilute or contains silica. The colourless, transparent, orthorhombic crystals resemble olivine in habit, angles, and optical characters; twins on *m*(110) are common. The material is easily attacked by hydrochloric acid. Analysis gave

SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	Na_2O.	K_2O.	H_2O.	Total.
40·78	36·73	trace	0·15	15·40	1·88	4·93	99·87

This agrees with $15SiO_2,8Al_2O_3,6R_2O + 6H_2O$, which is an orthosilicate with water. On heating the crystals to bright redness, they lose water, but still remain limpid, there being a slight change in the optical characters, and a change of sp. gr. from 2·377 to 2·463. The crystalline form of the substance is therefore independent of the contained water.

L. J. S.

Analcite. By Georges Friedel (*Bull. Soc. fran. Min.*, 1896, **19**, 14—18).—The behaviour of analcite ($Na_2O,Al_2O_3,4SiO_2,2H_2O$), when heated, is analogous to that of the new orthorhombic silicate (see preceding abstract), the water being lost with modification of the optical character and specific gravity, but without any change in the outward crystalline form. When analcite is heated, the crystals still remain more or less transparent, but become more strongly doubly refracting. Crystals from the Cyclopean Islands, when raised to a bright red heat, changed in sp. gr. from 2·277 to 2·179, and at a higher temperature they became isotropic, being then apparently permanently cubic. Some authors have considered that the double refraction of this mineral is connected with the loss of water, but this is not confirmed by the result obtained on heating analcite crystals in water to about 500°, as they remain unaltered and are still doubly refracting.

The water lost at various temperatures is given as: at 100°, none; 220—240°, 0·23 per cent.; 300—320°, total loss of 3·2 per cent.

L. J. S.

Natrolite from Moravia. By C. Friedrich Eichleiter (*Verh. k. k. geol. Reichsanst.*, 1895, 485—486).—Radially columnar aggregates of large crystals of white natrolite from the eruptive rocks at Palzendorf, Moravia, gave the following results.

SiO_2.	Al_2O_3.	Na_2O.	H_2O.	Total.
47·85	27·30	15·55	9·30	100·00
47·45	27·10	15·71	9·35	99·61

This agrees with the usual formula $Na_2Al_2Si_3O_{10} + 2H_2O$. Traces of calcium, but no iron, are present. Sp. gr. 2·229.

L. J. S.

Asbestos from Bosnia. By Heinrich von Foullon (*Verh. k. k. geol. Reichsanst.*, 1895, 365—367).—In the weathered Triassic (Werfen) slates near Alilovci in N.W. Bosnia, are loose, irregular pieces of an asbestos-like mineral; it is also found in the associated limestone blocks, and is clearly of secondary origin. It is lavender-blue and finely fibrous. Analysis by L. Schneider gave

							Loss on ignition.		
SiO_2.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	CO_2.	—.	Total.
54·10	15·76	7·33	12·60	1·44	5·40	0·45	0·09	2·81	99·98

It fuses easily to a black enamel. The mineral, as shown by its composition and outward appearance, is identical with the author's rhodusite from the Island of Rhodes (Abstr., 1894, ii, 461). L. J. S.

[**Altered Biotite and Tremolite from Styria.**] By Richard Canaval (*Mitth. Ver. Steiermark*, 1895, **31**, 39—43).—In a paper describing the occurrence and working of the cupriferous pyrites at Kallwang, in Upper Styria, are given the following analyses of minerals from the rocks bearing the ore. I is of the green material (vermiculite), originating by the chloritisation of the biotite, in a rock containing quartz, felspar, and carbonates. II is of colourless needles of tremolite, sp. gr. 2·952, from a rock containing also calcite, quartz, and a serpentine-like substance.

SiO_2.	Fe_2O_3.	FeO.	Al_2O_3.	MnO.	CaO.	MgO.	K_2O.	H_2O.	Total.
31·782	4·075	17·751	27·534	2·764	1·735	5·855	—	8·545	100·041
51·246	—	4·449	—	1·605	13·354	24·985	1·754	2·586	99·979

L. J. S.

Dolomite from Graz. By J. A. Ippen (*Mitth. Ver. Steiermark*, 1895, **31**, 272—275).—Specimens of dolomite rock from the Schlossberg at Graz gave the following results on analysis.

$CaCO_3$.	$MgCO_3$.	$FeCO_3$.	Insol. (SiO_2).	H_2O.	Total.
53·27	41·77	1·63	1·42	0·96	99·05
55·07	41·78	1·44	1·26	0·64	100·19
55·10	43·93	trace	0·30	not det.	99·33

L. J. S.

Disintegration of Granite in the District of Columbia. By George P. Merrill (*Bull. Geol. Soc. Amer.*, 1895, **6**, 321—332).—The rock when fresh is a grey, foliated and jointed, micaceous granite, analysis I; nearer the surface it is brown and friable, II; whilst still higher it is converted into sand and gravel, passing upwards into soil, III.

	Ignition.	SiO_2.	TiO_2.	Al_2O_3.	FeO.	Fe_2O_3.	CaO.	MgO.	Na_2O.	K_2O.	P_2O_5.	Total.
I.	1·22	69·33	not det.	14·33	3·60	—	3·21	2·44	2·70	2·67	0·10	99·60
II.	3·27	66·82	not det.	15·62	1·69	1·88	3·13	2·76	2·58	2·04	not det.	99·79
III.	4·70	65·69	0·31	15·23	4·39		2·63	2·64	2·12	2·00	0·055	99·765

The disintegration has here been effected without any important change in composition beyond hydration and oxidation of the iron, and in this differs from the ordinary weathering of granite. The minerals, even in their smallest fragments, are in most cases quite fresh; and the disintegration is attributed to the unequal expansion of the minerals on hydration. Cold water extracts from the soil 0·0138 per cent., and hydrochloric acid 3·609 per cent. L. J. S.

The Smithville Meteoric Iron. By Oliver W. Huntington (*Proc. Amer. Acad.*, 1894, **29**, 251—260).—Three masses, weighing about 7, 15, and 65 lbs. were ploughed up in 1892 near Smithville, De Kalb Co., Tennessee; they closely resemble the Cocke Co. iron. The iron shows a marked octahedral cleavage, and encloses nodules of troilite embedded in graphite and schreibersite; small crystals of cliftonite and perhaps also diamond are present. Analysis gave

Fe.	Ni.	Co.	Cu.	P.	Residue (mainly cliftonite).	Total.
91·57	7·02	0·62	trace	0·18	0·15	99·54

This analysis is compared with those of other irons from Tennessee and West Virginia, and it is pointed out that many of these may have originally formed part of the Cocke Co. fall. L. J. S.

Physiological Chemistry.

Gastric Digestion. By John Sjöquist (*Chem. Centr.*, 1895, ii, 1127; from *Skand. Arch. f. Physiol.*, **5**, 277).—For the author's method for estimating hydrochloric acid in gastric juice, see this vol., ii, 496.

Peptic digestion is stated to occur in two phases similar to those noticed in the inversion of cane sugar. W. D. H.

Action of Dilute Acids on Metabolism. By James Craufurd Dunlop (*J. Physiol.*, 1896, **20**, 82—96).—The observations recorded were made on human beings, and full details are given of the analyses of urine, fæces, and diet. After the administration of large doses of dilute mineral acids, the following phenomena were observed:—A great diuresis; a slight increase of the total, but not of the percentage, acidity of the urine; an increased excretion of nitrogen, which fell, not on the urea, but on the ammonia and extractives, and an increased excretion of sodium salts. W. D. H.

Hæmoglobin and its Derivatives. By JEANNOT GEORGENBURGER (*Chem. Centr.*, 1895, i, 701—702; from *Pharm. Zeits. Russ.*, **34**, 102—104).—Hæmoglobin, hæmol, and hæmogallol were given with the food, and their value in nutrition gauged by the amount found in the fæces. The pigment after extraction was estimated by the spectroscope. 75 per cent. of hæmol was absorbed. The figures for the other substances are only approximate. W. D. H.

Solubility of Carbonic Oxide in Solutions of Hæmoglobin: Dissociation of Carbonic Oxide Hæmoglobin. By C. GUSTAV HÜFNER (*Chem. Centr.*, 1895, ii, 308—309; from *Du Bois Reymond's Archiv*, 1895, 209—212, 213—214).—The absorption coefficient of carbonic oxide in solutions of hæmoglobin varies from 0·0213 at 19·5° to 0·0221 at 20·2°. It is therefore less than in pure water, where the absorption coefficient at 19·6° is 0·0233.

The dissociation constant of carbonic oxide hæmoglobin is about 33 times smaller than that of oxyhæmoglobin. Boehm's experiments (*Arch. exp. Path. Pharm.*, **35**, 16) on the toxic effects of certain alkaloïds are probably to be explained by an analogous increase in the difficulty of dissociation between them and the substance of nerve cells. W. D. H.

Compounds of Fatty acids with Cholesterol in Blood-serum. By KARL HÜRTHLE (*Zeit. physiol. Chem.*, 1896, **21**, 331—359).—If blood-serum is first treated several times with alcohol, and then extracted with a mixture of alcohol and ether, two crystalline substances, melting at 43° and 77°, are obtained from the extract; on treatment with concentrated sulphuric acid, they show reactions similar to those of cholesterol, but in a modified manner. By treatment with alcoholic potash, they are decomposed into cholesterol and potassium soaps, the substances being really fatty acid compounds of cholesterol, namely the oleate and palmitate. The stearate was not found. It, however, and the others were made synthetically. The serum contains from 0·08 to 0·2 of the oleate, and from 0·006 to 0·008 of the palmitate.

Cholesterylic oleate crystallises in long, thin needles, melts at about 41°, and is soluble in ether, chloroform, and benzene, but only sparingly in alcohol; the rotatory power $\alpha_D = 18° 48'$. The *palmitate* forms snow-white plates, melting at 77—78°. W. D. H.

Formation of Lymph. By W. S. LAZARUS-BARLOW (*J. Physiol.*, 1896, **19**, 418—465).—In favour of the view that osmosis and increased filtration are the effective factors in producing the increased outflow of lymph which follows the injection of a crystalloïd into the blood, there are the following points :—

1. The evidence given by the lowering in specific gravity of the blood after injection of comparable quantities of molecular solutions of sodium chloride, glucose, and urea, which is found to vary directly as the initial rate of osmosis (through a copper ferrocyanide membrane) of the substance injected.

2. The fact that in a few cases the injection is followed by a temporary diminution in the outflow of lymph from a cannula placed in the thoracic duct.

3. The fact that the increased flow varies directly as the lowering of the specific gravity of the blood.

4. The fact that with large injections of weak sodium chloride solution in amounts bearing a constant ratio to the theoretical volume of the animal's blood, the ratio between the amounts of lymph formed before and after injection is practically a constant.

Against this view, there are following nine points :—

1. The initial fall in the sp. gr. of the blood after injection of concentrated solutions is frequently over compensated, and this occurs also after large injections of liquids having a smaller initial rate of osmosis than lymph or blood-plasma.

2. The fact that in most cases there is no initial diminution in the outflow of lymph.

3. The fact that in a few cases the injection may diminish the outflow, but the subsequent injection of another crystalloïd may increase it.

4. The fact that after the water in the tissues has been lessened by an outflow of lymph, injection of a crystalloïd with a lower initial rate of osmosis may lead to a greater increase of lymph than under normal circumstances.

5. The initial rate of osmosis of the lymph may be higher than that of the blood-serum.

6. The maximum outflow does not occur at the time of maximum intravenous pressure.

7. If the venous pressure is kept increased in a hind limb for an hour, or if the sciatic nerve is cut, there is in neither case an increase in lymph flow.

8. An initial diminution in lymph flow is produced by injection of an insoluble substance like lamp-black.

9. The assumption that the vessel walls are more nearly akin to a copper ferrocyanide membrane than to an animal membrane like peritoneum is improbable. W. D. H.

Hygienic Studies on Copper. By Karl B. Lehmann (*Chem. Centr.*, 1895, ii, 541—543; from *Arch. Hyg.*, **24**, 1—17, 18—72, 72—83).—Copper occurs in numerous articles of diet; quantitative results and methods of analysis are given. It is calculated that in our food we take about 20 milligrams of copper daily; but if preserves are much used, it may rise to over 300 milligrams per diem; more than 120 milligrams appears to be harmful. W. D. H.

Absorption of Iron by the Organism. By JOHANNES TIRMANN (*Chem. Centr.*, 1891, ii, 407—408, 497—498; from *Pharm. Zeits. Russ.*, **34**, 403—405, 433—439).—Many observers believe that inorganic compounds of iron are not absorbed, but that organic compounds like hæmatogen (Bunge) or ferratin (Schmiedeberg) form the source of iron to the body. Artificial ferratin, prepared from alkali-albumin, and tartrate of iron and sodium, is not the same thing as the material separated from the liver by Schmiedeberg, and is not much more easily absorbed. Excretion of iron is normally chiefly performed by the mucous membrane of the intestine, only 10 per cent. leaving by the urine. Crystalline hæmoglobin, hæmogallol, and hæmatin are well absorbed, and the iron of the urine rises; these substances do good in cases of chlorosis. W. D. H.

Muscular Work and Glycogen. By JOSEF SEEGEN (*Chem. Centr.*, 1895, ii, 233; from *Centr. Physiol.*, **9**, 193).—From the examination of the blood entering and leaving a working muscle, the conclusion is drawn that the muscular glycogen is only in a very small degree the source of muscular work; the sugar of the blood is believed to be the most important substance from this point of view.
W. D. H.

Elimination of Carbonic Anhydride from Phosphorcarnic acid by Hydrolysis. By TH. RICHARD KRÜGER (*Zeit. physiol. Chem.*, 1896, **22**, 95—102).—By hydrolysis of phosphorcarnic acid (Abstr., 1895, i, 313), carbonic anhydride is given off; in extracts of muscle, no other substance yields carbonic anhydride on hydrolysis with simultaneous oxidation by means of iron chloride. Phosphorcarnic acid is, therefore, regarded as the material which, during muscular activity, gives off carbonic anhydride without using up oxygen. W. D. H.

Iodine Compounds in the Thyroid. By EUGEN BAUMANN and ERNST ROOS (*Zeit. physiol. Chem.*, 1896, **21**, 481—493).—The substance called thyroiodin (this vol., ii, 263) is not destroyed nor dissolved by the action of heat, or sulphuric acid (1 in 10), or hydrochloric acid (10 per cent.). It can, therefore, be separated from the other constituents of the gland which dissolve in these reagents. It is not of the nature of a proteïd or enzyme.

The proteïds of the gland are an albumin with which the greater part of the thyroiodin is combined, and a globulin with which a small part of the thyroiodin is in combination. These, with a small amount of free thyroiodin, are soluble in physiological saline solution. In the sheep's thyroid, the percentage of iodine in the dried organ varies from 0·9 to 1·5, and in the fresh organ from 0·26 to 0·44. Clinical and experimental evidence points to thyroiodin as the active physiological material in thyroid extracts. W. D. H.

Iodine in the Thyroid. By EUGEN BAUMANN (*Zeit. physiol. Chem.*, 1896, **22**, 1—17; compare this vol., ii, 263).—A large number of analyses of thyroids are given so far as the amount of iodine obtainable from them is concerned.

Human thyroids were examined after death from a large number of diseases; the cases of children are separated from those of adults; a number of the lower animals were also examined. The following table gives the main results.

	Dry weight of organ.	Iodine in 1 gram of organ.
Adult human thyroid; average of 26 cases, Freiburg....	8·2	0·33
" " " " 30 " Hamburg...	4·6	0·83
" " " " 11 " Berlin.....	7·4	0·9
Children's " " 39 "	—	0 or traces

In dogs, little or no iodine was found; it was increased by feeding on dog biscuit. In other animals, it is much the same as in man. Iodine was found in calf's thymus. W. D. H.

Action of Thyroiodin. By Ernst Roos (*Zeit. physiol. Chem.*, 1896, **22**, 18—61; compare Abstr., 1895, ii, 516).—The activity of thyroids and thyroid extracts depends on the presence of thyroiodin. This substance acts on the general system, on the thyroid gland itself, on cases of myxœdema and psoriasis, and on metabolism in the same way as thyroid extracts. Details of a large number of clinical cases are given. W. D. H.

Nucleïn and the Formation of Uric acid. By Wilhelm Weintraud (*Chem. Centr.*, 1895, ii, 234; from *Berlin klin. Woch.*, **32**, 405—409).—Administration of thymus as food causes a large increase of uric acid in the urine. This is produced chiefly by the absorption of nucleïn from the food, and only in a small degree arises indirectly by the diet increasing the number of leucocytes.

W. D. H.

Formation of Uric acid in Man. By Wilhelm Weintraud (*Chem. Centr.*, 1895, ii, 310—311; from *Du Bois Reymond's Archiv*, 1895, 382—385).—By feeding on cooked thymus, the basic nitrogen and the phosphoric acid of the urine are increased in the urine, but not in the fæces. Only a small part of the absorbed nucleïn is changed into uric acid; it is probable that the uric acid is discharged into the intestine. W. D. H.

Fibrin-ferment and Nucleo-proteïd. By Cornelius A. Pekelharing (*Chem. Centr.*, 1895, ii, 53; from *Centr. Physiol.*, **9**, 102).—Halliburton and Brodie stated that there were numerous differences between fibrin-ferment and nucleo-proteïd; the present communication shows that these are all susceptible of explanation.

W. D. H.

Note by Abstractor.—Halliburton and Brodie have more recently (*J. Physiol.*, **18**, 306) and independently arrived at the same conclusion, namely that fibrin-ferment is a nucleo-proteïd.—W. D. H.

Chemistry of Mitosis. By L. Heine (*Zeit. physiol. Chem.*, 1896, **21**, 494—506).—Lilienfeld concludes from microchemical work that in the dividing nucleus of cells, free nucleïc acid is liberated. In the present research, this conclusion is questioned; the only change that occurs is one in the physical groupings of the chromatic filaments.

The microchemical reactions described for distinguishing between free nucleïc acid and its proteïd compounds, and between acidophile and basophile reactions as tested by aniline dyes, are not trustworthy. According to the previous treatment of the objects (method of hardening, &c.), any variety of selective colouring can be obtained. The results described are, therefore, chiefly of histological rather than of chemical interest. W. D. H.

Rennin and Milk Clotting. By Arthur Edmunds (*J. Physiol.*, 1896, **19**, 466—476).—A small quantity of a milk-curdling ferment can be obtained from many tissues besides the stomach, namely, testis, liver, lung, muscle, kidney, spleen, thymus, thyroid, brain, blood, small intestine, ovary.

There is no evidence that caseïn can be reconverted into caseïnogen and re-coagulated by rennin, the apparent re-coagulation described by Peters (*Preisschrift Rostock*, 1894) being probably due to calcium salts present in the rennet extract.

Peptone has a marked retarding effect on coagulation, which may be partly neutralised by calcium chloride.

Caseïn is soluble in ammonium oxalate solution without being reconverted into "caseïnogen."

Grimaux's "colloïde aspartique" has no coagulating effect on milk. W. D. H.

Effect of Borax on Milk Curdling. By F. J. Allen (*Lancet*, 1896, **1**, 1516).—Milk containing one-tenth of its volume of cold saturated solution of borax will not curdle with rennet; but this property is restored by calcium chloride. Boric acid, on the other hand, hastens rather than hinders rennet activity. The conclusion that the action of borax is due to the base rather than to the acid was confirmed by the discovery that sodium hydrogen carbonate has the same action as borax, if one-sixth of a 5 per cent. solution is added to the milk. This also is neutralised by calcium chloride. W. D. H.

Absorption and Excretion of Lime. By J. G. Rey (*Chem. Centr.*; 1895, ii, 55—56, and 837; from *Arch. exp. Path. Pharm.*, **35**, 295—305; and *Deut. med. Woch.*, **21**, 569—572).—On subcutaneous injection of lime and calcium salts in dogs, a small part (12—13 per cent.) appears in the urine, the remainder being excreted into the intestine, especially the large intestine.

In rickets, the absorption of calcium compounds from the intestine is lessened, although this can hardly be considered the cause of the disease. In osteomalacia, the calcium in the urine suddenly sinks about the twelfth day; this is possibly an indication of commencing repair. W. D. H.

Pentosuria. By Ernst L. Salkowski (*Chem. Centr.*, 1895, ii, 177—178; from *Berlin klin. Woch.*, **32**, 364).—Two new cases of pentose in the urine are described. The abnormal constituent was found for a considerable time, but no cause in the way of diet could be found to account for it. It is absent from diabetic urine. Hammarsten separated a pentose from the nucleo-proteïd of the pancreas; thus pentose may originate within the body, and if oxidation processes are lessened, may leave in the urine as such. W. D. H.

Milk Sugar in the Urine after Child-birth. By F. A. Lemaire (*Zeit. physiol. Chem.*, 1896, **21**, 442).—The presence of lactose in the urine of women after delivery has been often mooted, and a certain result is now arrived at by employing Baumann's benzoic chloride method of separating carbohydrates. The osazones of the carbohydrates were then prepared.

Baisch's result that normal urine contains glucose and a dextrin-like substance is confirmed; isomaltose was also found; and in fifteen cases after child-birth, but not before delivery, lactose was found too. The figures given are as follows:—

	Ante partum.	Post partum.
Glucose, per cent.......	0·004 to 0·008	0·007 to 0·014
Isomaltose, per cent. ...	0·001 „ 0·002	0·002 „ 0·0035
Lactose, per cent.......	none	0·01 „ 0·04

W. D. H.

The Relationship of Levulinic acid to Acetonuria. By Wilhelm Weintraud (*Chem. Centr.*, 1895, i, 292; from *Arch. exp. Path. Pharm.*, **34**, 367—373).—Levulinic acid is regarded as the intermediate parent substance between the proteïds of the body and the acetone and acetoacetic acid of the urine of diabetic patients. It is especially a decomposition product of the nuclei of cells. It is not toxic, although Jaksch has stated that it is. W. D. H.

Excretion of Uric acid and Xanthine Bases by the Fæces. By Wilhelm Weintraud (*Chem. Centr.*, 1895, ii, 54—55; from *Centr. Klu. Med.*, **16**, 433—436).—In a case of leucæmia the rise of uric acid in the urine was found not to correspond with the increased number of leucocytes; here, however, an enormous increase in the xanthine bases of the fæces was found. These bases always occur in the fæces and are regarded as a true excretion, not as food residues.

W. D. H.

Solubilities of Uric acid in Urine. By Fred. J. Smale (*Chem. Centr.*, 1895, ii, 833—834; from *Centr. Physiol.*, **9**, 385—390).—At 40°, uric acid is soluble in 2400 parts of water, which is more than has been found hitherto. In solutions of sodium chloride, the solubility is less; this varies with temperature, and tables of the solubility of uric acid in solutions of this and other salts are given.

There is more uric acid in the urine than is indicated by the silver method, as a part of the compound is held in solution by the urea present. W. D. H.

The Precipitation of Urates within and without the Body. By C. MORDHORST (*Chem. Centr.*, 1895, ii, 795—797; from *Centr. inn. Med.*, **16**, 841—847).—This paper is a discussion as to the relationships of the reactions of the various juices and secretions of the body, and how changes in these reactions may determine the precipitation of uric acid or urates as in an attack of acute gout.

W. D. H.

Alloxuric Substances in the Urine of Children in Disease. By ADOLF BAGINSKY and PAUL SOMMERFELD (*Zeit. physiol. Chem.*, 1896, **21**, 412—421).—Seven cases of diseases in children are described; the following points were noted in their urine.

1. Nephritis after whooping cough. Alloxuric bases (A) increased, uric acid (B) diminished; total alloxuric substances (C) increased.

2. Nephritis and endocarditis; (A) increased, (B) diminished, (C) normal.

3. Scarlatina, (A) increased; (B) normal; (C) increased.
4. Ditto (A) „ (B) diminished; (C) normal.
5. Diphtheria, (A) „ (B) normal; (C) increased.
6. Ditto (A) „ (B) diminished; (C) diminished.
7. Diabetes (A) „ (B) increased; (C) increased.

W. D. H.

Indican, Indoxylsulphuric acid, and Conjugated Glycuronic acids in the Urine. By A. DAIBER (*Chem. Centr.*, 1895, ii, 309; from *Schweiz. Woch. Pharm.*, **33**, 229—236).—A number of urines were analysed; some contained only indoxylsulphuric acid, others only indican, and others sugar and indoxylglycuronic acid. The latter substance is lævorotatory, and so influences the rotation as well as the reducing power of the urine in the estimation of the sugar.

W. D. H.

Poisoning with Potassium Chlorate. By KURT BRANDENBURG (*Chem. Centr.*, 1895, ii, 685; foom *Berlin Klin. Woch.*, **32**, 583—586).—The blood of a suicide who took 40 grams of potassium chlorate was rich in methæmoglobin; the corpuscles were broken up. There was icterus, and during the first two days methæmoglobin passed into the urine. The total solids of the blood were lessened.

W. D. H.

Physiological Action of Cadmium. By CESARE PADERI (*Chem. Centr.*, 1895, i, 794; from *Arch. Farm. terapeutica*, **3**).—Cadmium paralyses the central nervous system; it extends centrifugally, the muscles being influenced last. The effect on the heart is produced partly on its nerves, partly on its muscular substance. Cadmium is an antiseptic.

W. D. H.

Physiological Action of Thallium. By ANTONIO CURCI (*Chem. Centr.*, 1895, ii, 999; from *Ann. Chim. Farm.*, **22**, 441—449).—Thallium and its salts depress the heart and circulation in frogs. In dogs, the pulse becomes slower, although the pressure rises as with alkalis generally. After a dose of curare, large enough to affect the heart and vaso-motor nerves, thallium, like potassium, causes a rise of blood pressure.

W. D. H.

Toxicity of Acetylene. By Rudolf Rosemann (*Chem. Centr.*, 1895, ii, 998—999; from *Arch. exp. Path. Pharm.*, **38**, 178—196).—Acetylene, prepared from calcium carbide, contained hydrogen phosphide and sulphide. This impure product is less poisonous than coal gas. It produces no change in the blood; it causes sleepiness, the respiration becoming slow, deep, and finally dyspnœic. Some animals vomited. Its action appears to be on the nervous system.

W. D. H.

Physiological Action of Ureides. I. Alloxan, Alloxantin, and Parabanic acid. By Valerio Lusini (*Chem. Centr.*, 1895, ii, 311, 727—728, 838; from *Ann. Chim. Farm.*, **21**, 241—257, **22**, 341—351, 385—394).—Alloxan increases nervous irritability and acts also, but with less intensity, on the muscles. It leaves the body in the urine as alloxantin and parabanic acid. Alloxantin behaves like alloxan in its physiological action, but is especially poisonous to cold blooded animals. The blood shows strongly reducing properties; this is not produced by the other two substances. Given by the stomach, it appears in the urine chiefly as parabanic acid, and in smaller quantities as dialuric acid, murexide, and alloxantin itself. Parabanic acid lessens the secretion of the skin, produces midriasis, increases reflexes, and finally kills in a state of torpor, the heart stopping in diastole.

All these substances act on the central nervous system, producing first stimulation, then paralysis. Alloxan is the most, and parabanic acid the least poisonous. W. D. H.

Physiological Action of Gentisic acid. By Alexis Likhatscheff (*Zeit. physiol. Chem.*, 1896, **21**, 422—441).—Homogentisic (2 : 5-dihydroxyphenylacetic) acid is the substance formed in urine in cases of so-called alcaptonuria. Experiments were in the present research made on dogs; it is almost harmless, and appears as such in the urine, and does not unite in the organism with sulphuric acid. Gentisic acid, however, is poisonous, and unites with sulphuric acid, giving rise to an increase of ethereal sulphates in the urine; part, however, remains unaltered, and is excreted as such. Quinol is strongly toxic and is excreted in the form of ethereal sulphate alone.

In alcaptonuria there is no rise in the excretion of ethereal sulphates, and so no gentisic accompanies the homogentisic acid.

W. D. H.

Physiological Action of Caffeïne and Theobromine. By Manfredi Albanese (*Chem. Centr.*, 1895, ii, 234—235; from *Arch. Exp. Path. Pharm.*, **35**, 449—466).—Caffeïne given to dogs leaves the body in the urine as a methylxanthine; this, however, is only an intermediate product, since if it is itself injected subcutaneously, very little is found in the urine. This methylxanthine is probably identical with heteroxanthine. Theobromine is partly decomposed in the same way. W. D. H.

Alkaloïds of Hydrastis Canadensis. By Kuno von Bunge (*Chem. Centr.*, 1895, i, 1173—1175; from *Arb. Pharm. Inst. Dorpat.*, **11** and **12**).—Hydrastinine gives precipitates which are mostly yellow, and some crystalline, with the various precipitants of alkaloïds. Potassio-mercuric iodide will detect it when diluted with 100,000 parts of water. It has no effect on red corpuscles; it paralyses the peripheral nerves and muscles. Small doses do not affect the heart, but large ones paralyse the vagus. The kidney vessels are dilated. The fatal dose for cats is 0·3 gram per kilo. of body weight. It leaves the body unchanged, principally by the urine.

Canadine hydrochloride and sulphate were also examined. They are precipitable by a large number of reagents. Outside the body canadine causes a change in the pigment of the red corpuscles into methæmoglobin; internally it does not show this property, but increases the disposition of the blood to deposit para-hæmoglobin crystals. It acts paralysingly on the heart, and in larger doses on the brain and spinal cord, and it increases intestinal movements. The fatal dose for cats is 0·2 gram per kilo. of body weight. It is not wholly absorbed from the alimentary canal, but that which is, leaves the body as oxalic acid in the urine. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Inversion of Cane Sugar by means of Micro-Organisms. By Claudio Fermi and Giuseppe Montesano (*Chem. Centr.*, 1895, ii, 712—713; from *Centr. Bakt. und Parasitenk.*, 1, 482—487, 542—546). —Of 70 species of micro-organism with which the authors have worked, only the following bring about inversion when added to a bouillon culture containing cane-sugar, *Bacillus megatererium*, *Proteus vulgaris*, *Bacillus fluoresc. liquef.*, white yeast, rose yeast. Cholera vibrios and *Vibrio Metschnikovii* are uncertain in their action.

When the bouillon is rendered alkaline with excess of magnesia *Bacillus fluoresc.*, *Proteus* and rose yeast lost their inverting powers. Most of the organisms retain this power in slightly acid solutions, one exception to this is *Vibrio Metschnikovii*. Invertase is also formed when glycerol takes the place of cane sugar in the bouillon, but is not formed by certain bacteria in peptonised bouillon, nor in bouillon containing racemic acid. The beginning of the formation of invertase varies with the culture medium, and also with the special organisms; it usually, however, takes place two to three days after inoculation. In bouillon cultures containing cane sugar, no invert sugar can be detected during the first two days, although active invertase can be shown to be present.

Invertase is also formed in a medium containing no proteïd matter. In a pure 5 per cent. glycerol medium, *Aspergillus niger* and *Pencillium glaucum* alone yield invertase. The amount of invertase formed by mould fungi is always greater than that formed by Schizomycetes, and may be increased or diminished by means of heat. The invertase obtained from mould fungi may be heated to 100° for over an hour without being destroyed. Acids, especially inorganic acids, and alkalis, especially potash, rapidly destroy the enzyme.

J. J. S.

Biochemical Preparation of Sorbose. By Gabriel Bertrand (*Compt. rend.*, 1896, **122**, 900—903).—Sorbose does not exist ready formed in the juice of *Sorbus aucuparia*, *S. intermedia*, or *S. latifolia*. The juice of these plants rapidly ferments, all the glucose disappears, and a corresponding quantity of alcohol is formed, but when fermentation is complete the liquid contains no sorbose. At this point, the surface of the liquid is filled with *Saccharomyces vini*, which oxidises the alcohol, and often this is followed by *Penicillium glaucum* and other moulds, which completely alter the juice but without producing sorbose. Sometimes, however, small, reddish flies are attracted to the liquid, and it is then seen that the supernatant film becomes gelatinous and consistent, eventually loses its translucidity, and dries up with a greenish colour. The liquid then contains large quantities of sorbose.

The conversion of the sorbitol into sorbose is brought about by a microbe of 2 μ to 3 μ long, about 0·5 μ broad, which is introduced into the juice by the red fly previously mentioned. In order to obtain this ferment, a mixture of wine and vinegar or red wine with twice its volume of water is left exposed to the air in different places, until the microbe begins to develop its gelatinous colonies, thicker and more opaque in the central portions, which very soon become confluent, so that the membrane can be removed in one piece. The ferment is introduced into the juice of a fruit or into an artificial nutrient fluid containing sorbitol. In the case of the fruit juice, alcoholic fermentation must first be completely finished, and the liquid carefully filtered. The artificial nutrient fluid may be a solution of yeast or a 1 per cent. solution of peptone mixed with inorganic salts. Fermentation is allowed to go on in shallow vessels at 25° until the reducing power of the liquid with reference to Fehling's solution no longer increases.

C. H. B.

Nitrates in Seedlings. By Ernst Schulze (*Zeit. physiol. Chem.*, 1896, **22**, 82—89; compare Abstr., 1895, ii, 84).—The occurrence of nitrates in various etiolated seedlings has been noted previously, the nitric acid being formed from proteïd matter during germination. The circulating nitrogen, however, is generally and mostly in the form of amides, and in the cases of *Lupinus angustifolius*, *L. albus*, *Vicia sativa*, *Ricinus communis*, and *Zea Mays* the search for nitrates during the first 14 days of growth gave negative results.

W. D. H.

Saps. By Alexandre Hébert (*Bull. Soc. Chim.*, [3], **13**, 927—932).—The author has examined the saps of certain varieties of plants, namely, of a creeper of the Ampelocissus tribe from the French Congo, of the Banana tree (*Musa paradisica*), and of the vine (*Vitis vinifera*). The first is characterised by containing a comparatively large percentage of iron.

The sap of *Musa paradisica* contains tannin, gallic acid, acetic acid, sodium chloride, and salts of calcium, potassium, and aluminium.

The sap of the vine, on treatment with lead acetate, yields a substance giving, with phenylhydrazine, an osazone melting at 205°, which is the melting point of glucosazone. J. F. T.

Some Constituents of Nettles. By ERCOLE GIUSTINIANI (*Gazzetta*, 1896, **26**, i, 1—7).—The author has examined *Urtica urens* and *Urtica dioica* with the object of determining to which constituents they owe their powerful hæmostatic action. No alkaloïds could be extracted from the plants, either before or after flowering. The freshly expressed juice of the nettles collected before flowering has occurred gives off nitrous vapours when heated or distilled, but the amount of such vapours evolved diminishes greatly as the plant reaches maturity, and the aqueous extract of the dried plant gives off no nitrous vapours on distillation; this behaviour is probably due to the simultaneous presence of formic acid and nitrates in the plant juices. The nettle probably contains a glucoside, which readily undergoes hydrolysis with formation of one or more volatile acids.

W. J. P.

Chemical Characteristics of Bilberry Juice. By W. NACKEN (*Chem. Centr.*, 1895, **66**, 1084; from *Forsch. Ber. Lebens. Hyg.*, **2**, 350—361).—The colouring matter is best isolated by treating the juice, which has been previously nearly neutralised with soda, with hide powder. The hide powder takes up the colouring matter from the juice in the course of two days, and is then collected and well washed with water; the colouring matter is extracted with dilute hydrochloric acid, and may be precipitated from the solution by dilute soda. When moist, it forms an indigo-blue paste, but when dry, a bluish-black mass with a reddish lustre. It dissolves in mineral and organic acids, but is insoluble in water, alcohol, ether, chloroform, or benzene. The solution changes to dark brown when treated with ferric chloride, to violet with copper sulphate or zinc chloride, and to indigo-blue with lead acetate. It reduces Fehling's solution, and is decomposed by hot concentrated sulphuric acid, a compound, $C_{14}H_{14}O_7$, being thrown down when the dark red solution thus obtained is diluted with water. Nitric acid oxidises the colouring matter to picric and oxalic acids. It slowly decomposes on standing; and its acid solution, when boiled, evolves 4·9 per cent. of carbonic anhydride; it is readily acetylated, and apparently has the composition $C_{10}H_{12}O_8$. When chlorine is passed into the juice, a bright grey, amorphous precipitate is obtained. This contains 24·77 per cent. of chlorine, and is sparingly soluble in water but readily in alcohol, has acid properties, reduces Fehling's solution, and can readily be benzoylated.

Considerable quantities of citric and malic acids are present in the juice, but no tartaric or oxalic acid. The carbohydrates present include glucoses, pentoses, and inositol.

The fermentation products of the juice include aldehyde, and capric, propionic, valeric, and butyric acids. J. J. S.

Nitric acid in the Waters of the Seine and its Chief Tributaries. By J. J. THÉOPHILE SCHLOESING (*Compt. rend.*, 1896, **122**, 699—703).—The author has continued his investigations of the quantity of nitrates in the waters of the Seine, Marne, Yonne, and Oise (Abstr., 1895, ii, 286), and has made estimations throughout 1895. The variations are approximately the same in all four rivers; the proportion of nitric acid is at a minimum (3 to 4 milligrams per litre) in July, August, and September, gradually increases until it reaches a maximum (9 to 10 milligrams per litre) in January or February, and then decreases again. The proportion of nitric acid has no definite relation to the volume of water passing down the stream. The maximum corresponds with a period of the year when surface drainage is small and the activity of aquatic plants is low; the minimum corresponds with the season when the activity of aquatic vegetation is at its maximum. C. H. B.

Apparatus for estimating the Water-holding Power of Soils. By J. L. BEESON (*J. Amer. Chem. Soc.*, 1895, **17**, 769—771).—The apparatus looks, at first sight, like a nitrometer. Inside the wider tube is placed a perforated disc, which is afterwards covered with filter paper, the disc being connected with a pressure tube, bent downwards at its upper end. The soil to be tested is placed on the disc, and by raising the narrow tube of the apparatus a known volume of water is forced through the soil; the tube is then lowered, and the volume of water again measured. The difference in the two readings represents the water absorbed by the soil. L. DE K.

Analytical Chemistry.

Estimation of Hydrogen by means of Palladious Chloride. By EDWARD D. CAMPBELL and E. B. HART (*Amer. Chem. J.*, 1896, **18**, 294—298).—A freshly prepared, nearly neutral 1 per cent. solution of palladious chloride completely absorbs small quantities of hydrogen in the course of two hours. No advantage is gained by using a stronger solution, whilst the absorption is retarded if the solution be strongly acid. A. L.

Estimation of Free Hydrochloric acid in Gastric Juice. By JOHN SJÖQUIST (*Zeit. anal. Chem.*, 1896, **35**, 240—253; from *Skandinav. Archiv. Physiol.*, **5**, 277).—The author has somewhat modified his process (Abstr., 1893, ii, 433) by converting the barium chloride, resulting from the action of the gastric juice on barium carbonate, into chromate, and estimating the latter by Zulkowsky's iodimetric method. 10 c.c. of the gastric juice is mixed in a platinum basin with 0·5 gram of barium carbonate, evaporated to dryness and gently incinerated. The ash is exhausted with boiling water, and the solution is mixed with ammonium acetate, acetic acid, and ammonium chromate. The precipitate is washed free from soluble chromates, diffused in 10 c.c. of water, and treated with 2 c.c. of 30 per cent. potassium iodide solution and 5 c.c. of hydrochloric acid, and the liberated iodine is titrated with thiosulphate. Since 6 atoms of iodine are liberated for each 4 mols. of hydrochloric acid, a thiosulphate solution of about 31 grams per litre corresponds with 3 milligrams of hydrochloric acid per c.c. Objections to the method are discussed. M. J. S.

Detection of Fluorine in Beer. By RUDOLF HEFELMANN and PAUL MANN (*Chem. Centr.*, 1895, i, 1081; from *Pharm. Centr. Halle*, **16**, 249—250).—A crystalline compound containing 85 per cent. of silicon fluoride and 15 per cent. of ammonium fluoride is now largely used as an antiseptic. To detect fluorides in beer, 500 c.c. of the sample (freed from carbonic anhydride) is mixed with 1 c.c. of a mixture of equal parts of 10 per cent. calcium and barium chloride solutions, and then with 0·5 c.c. of 20 per cent. acetic acid. After adding 50 c.c. of 90 per cent. alcohol, the whole is left for 24 hours to allow the calcium fluoride and barium silicofluoride to settle. The precipitate is collected, and at once dried in a platinum crucible. The fluorine is now tested for, in the usual way, by heating with 1 c.c. of sulphuric acid, and noticing the action of the fumes on a watch glass. L. DE K.

Detection of Fluorine in Wine. By G. NIVIÈRE and A. HUBERT (*Chem. Centr.*, 1895, ii, 251; from *Mon. scient*, [4], **9**, 1).—One hundred c.c. of the sample is rendered alkaline with aqueous soda, and boiled for a few minutes with 2—3 c.c. of a 10 per cent. solution of calcium chloride. The precipitate is collected on a filter and, after ignition, the residue is mixed with one-third of its weight of precipitated silicic acid. The mixture is then heated with a mixture of equal parts of ordinary and fuming sulphuric acid in a small test-tube connected with a small-pattern nitrogen bulb. The presence of 1 gram of ammonium fluoride in 100 litres of wine may be detected by the cloudiness of the water in the bulb-apparatus. The contents of the bulbs may then be filtered, and precipitated by means of a solution of potassium acetate in very weak alcohol; a precipitate of potassium silicofluoride is thus obtained, which may be weighed.

L. DE K.

Estimation of Sulphur in Refined Copper. By G. L. HEATH (*J. Amer. Chem. Soc.*, 1895, **17**, 814—821).—Ten grams of the sample is dissolved in a mixture of 60 c.c. of nitric acid (sp. gr. 1·42) and 15 c.c. of hydrochloric acid (sp. gr. 1·20), and the whole is evaporated to dryness. To ensure the complete oxidation of the sulphur, the mass is again treated with 50 c.c. of nitric acid, and evaporated to dryness; this operation is then once more repeated. The residue is dissolved in 300 c.c. of water, adding, if necessary, a little nitric acid. After filtering, the liquid is diluted to about 600 c.c., and then subjected to electrolysis, a sheet of platinum of 4—5 in. serving as the negative electrode, whilst a small platinum foil serves as the positive one. A current equivalent to two 16-candle power lamps coupled in parallel will deposit the copper over night. The liquid free from copper, or nearly so, is evaporated with addition of a little sodium carbonate; when dry the mass is gently ignited to expel any ammonium nitrate. The evaporations are best done with the aid of a spirit lamp to avoid sulphurous fumes. The mass is now freed from nitric compounds by repeated evaporation with hydrochloric acid, and the sulphuric acid is finally precipitated as usual with barium chloride. It is advisable to make a blank experiment to learn exactly the amount of sulphuric acid contained in the reagents used. If the copper be not first removed by electrolysis, it will exercise a decided solvent action on the barium sulphate. If lead is present, traces of lead sulphate may remain on any of the filters, but the sulphuric acid may be easily recovered by boiling with a solution of sodium carbonate. L. DE K.

Estimation of Sulphur in roasted Copper Ores and Cupriferous Pyrites. By HARRY FREDERICK KELLER and MAAS (*Chem. Centr.*, 1895, ii, 412; from *J. Franklin Inst.*, 1895, 286).—0·5 gram of the finely powdered sample is introduced into a nickel crucible containing 5—6 grams of potassium hydroxide in a state of fusion, and when the mass has become red hot, 1 gram of sodium peroxide is added; the oxidation is complete after five minutes. The mass contains sulphate, which is then estimated as usual. If excess of sodium peroxide is used, a little copper dissolves, which interferes with the volumetric estimation of the sulphuric acid. L. DE K.

The Evolution Method for the Estimation of Sulphur in White Cast-iron. By FRANCIS C. PHILLIPS (*J. Amer. Chem. Soc.*, 1895, **17**, 891—900).—The author has modified this method so as to prevent loss of sulphur. The sample of iron is dissolved in hydrochloric acid of 1·12 sp. gr. in a current of carbonic anhydride. When the action becomes retarded, heat is applied. The hydrogen is passed through a porcelain combustion tube heated to redness, and containing a roll of platinum foil, 8 in. long. The delivery tube from the evolution flask must reach as far as the platinum, so that any oily drops which distil over may drop on it. The liquid in the flask is finally kept gently boiling until no more oily matter passes over, which may take over two hours. After escaping from the porcelain tube, the gas is absorbed in dilute hydrochloric acid containing bromine placed in a nitrogen flask. It is then again passed through a litre of the same solution contained in a large bottle. The sulphur is finally weighed as barium sulphate. The test-analyses show the great loss of sulphur taking place when using the old method, but they agree very well with those obtained by Blair's aqua regia method. L. DE K.

Estimation of Sulphur in Pyrites. By GEORG LUNGE (*J. Amer. Chem. Soc.*, 1895, **17**, 772—775).—A final reply to Gladding, upholding his own process. The author again states that when following the proper directions, the ferric hydroxide retains no sulphuric acid. The trace of barium chloride occluded by the barium sulphate is counterbalanced by the slight solubility of the sulphate in strongly acid liquids. L. DE K.

Detection of Free Sulphuric acid in Leather. By BALLAND and MALJEAN (*Chem. Centr.*, 1895, i, 1045; from *Rep. Pharm.*, 1895, 108).—The sample is dried at 80°, powdered, and extracted with alcohol. The filtrate is neutralised with potassium carbonate, evaporated to dryness, and the residue ignited; it is then tested for a sulphate. If a quantitative estimation is desired, 10 grams of the sample must be extracted with alcohol in a Soxhlet's apparatus. Estimating the sulphates by ignition before and after neutralising with potassium carbonate gives less trustworthy results.

L. DE K.

Arsenic in Glycerol. By G. E. BARTON (*J. Amer. Chem. Soc.*, 1895, **17**, 883—890).—Five grams of the sample is heated with 5 c.c. of a mixture of 30 parts of sulphuric acid and 1 part of nitric acid, with constant stirring, until a dry, charred mass is left; after cooling, 15 c.c. of water is added, and the mixture vigorously boiled to expel sulphurous anhydride. The liquid is then filtered, and the residue boiled twice with water to ensure the complete extraction of the arsenic. The liquid is then tested by the method proposed by Sanger for the estimation of arsenic in wall paper, which consists in comparing the arsenical mirrors yielded by the sample with those obtained from known amounts of arsenious oxide. In order to obviate the necessity of using chemically pure zinc and acid in the constant hydrogen generator, the author passes the gas through a solution of silver nitrate to free it from arsenic. In other respects, Sanger's instructions are followed. L. DE K.

Estimation of Graphite in Pig-iron. By PORTER W. SHIMER (*J. Amer. Chem. Soc.*, 1895, **17**, 873—876).—The higher results obtained by dissolving the sample in hydrochloric acid instead of nitric acid, have been ascribed to a supposed oxidation of the graphite by the latter acid.

The author has now distinctly proved that, on dissolving iron in hydrochloric acid, a not inconsiderable amount of titanium carbide remains, the carbon of which then counts as graphite. This compound is dissolved by nitric acid; the nitric acid process should therefore be used. L. DE K.

Estimation of Lime by an Alcoholic Solution of Potash-soap. By L. SZYFER (*Chem. Centr.*, 1895, i, 1082; from *Böhm. Zeit. f. Zuck. Ind.*, **19**, 408).—This well-known method is very suitable for estimating lime in saccharine liquids. The soap solution should be made of such a strength that 1 c.c. equals 0·001 gram of CaO, and 150 c.c. of the sample should not require more than 20 c c. of the soap; if it does, it must be suitably diluted. When testing acid juices, these should be first neutralised with ammonia. The lather should be permanent for at least five minutes. Sometimes it will be necessary to heat to 40° to promote the action. L. DE K.

Solubility of Barium Sulphate. By C. REMIGIUS FRESENIUS and E. HINTZ (*Zeit. anal. Chem.*, 1896, **35**, 170—183).—In consequence of the wide discrepancies between the statements of various authorities, the authors have made an extensive series of experiments with such liquids as are likely to occur in the course of sulphuric acid or barium estimations. The experiments were made by forming small amounts of barium sulphate from standard solutions of baryta and sulphuric acid in large volumes of the solvent, and observing the limit at which turbidity began to appear. Such mixtures as remained clear were, after 24 hours, divided, and treated with considerable excesses of barium chloride and sulphuric acid respectively, so as to imitate the conditions occurring in actual estimations. In all cases these additions diminished the solubility, so that with excess of sulphuric acid present 400,000 parts of each of the solvents given below were required to dissolve 1 part of barium sulphate. The other results obtained may be summarised as follows: the numbers given are the volumes in cubic millimetres requisite for retaining in clear solution 1 milligram of barium sulphate for at least 24 hours.

Water 100,000; water with excess of barium chloride 400,000. An 8 per cent. solution of ammonium chloride, 10,000; the same, + barium chloride, 50,000. A 2·3 per cent. solution of ammonium chloride, 22,000; the same with barium chloride, 80,000; a 2·3 per cent. solution of sodium chloride gives slightly lower solubilities than ammonium chloride. Nitric acid of 7—8 per cent., 7,300; the same with barium chloride, 33,000. Hydrochloric acid of 7—8 per cent. almost the same numbers as with nitric acid. M. J. S.

Volumetric Estimation of Metals precipitable by Alkalis, and Applications of the Method. By Dr. Ruoss (*Zeit. anal. Chem.*, 1896, **35**, 143—158).—The method depends on the well-known principle that the amount of a metal precipitable by an alkali may be known from the volume of standard alkali solution (hydroxide or carbonate, according to circumstances) consumed in precipitating it from its neutral solution. Phenolphthaleïn is used as indicator; standard alkali is added until a slight excess is found to be present after boiling; then, without removing the precipitate, but leaving it as far as possible undisturbed at the bottom of the beaker, the excess of alkali is titrated back with standard acid. Neutral solutions may in many cases be obtained from acid ones (zinc, copper, and alumina are instanced) by evaporating with sulphuric and nitric acids to complete dryness, and dissolving the residue in water. Acid solutions may also be neutralised by an alkali with methyl-orange as indicator, but, although the author describes with great minuteness the changes which occur, with regard to which he differs from Thomson as to the point of neutrality, he seems to make little use of this method.

In estimating the alkaline earths by precipitation with sodium carbonate, a pale pink colour is obtained before the sodium carbonate is in excess, owing to the solubility of the alkaline earthy carbonate. The simplest plan is to add an excess, boil and cool, and then, with as little disturbance of the subsided precipitate as possible, add acid, drop by drop; the red colour disappears when half the excess is neutralised.

The copper in the cuprous oxide obtained in sugar estimations may readily be estimated by the above method after dissolving in nitric acid. The presence of organic matter from a paper filter has no influence. The reduction of silver from an ammoniacal solution by glucose furnishes a new method of sugar titration, 1 mol. (179·58) of dextrose reducing 10 atoms (1076·6) of silver, so that in this case the sugar takes up twice as much oxygen as it does from cupric oxide. A silver solution containing 47·2075 grams of silver nitrate per litre will correspond with 0·005 gram of dextrose per c.c. The sugar solution is first freed from chlorides by the cautious addition of silver nitrate; milk of lime is added as usual, and the liquid diluted to 1 per cent. or less. 25 c.c. is then mixed in a flask with 50 c.c. of the silver solution, and 3 c.c. of ammonia of sp. gr. 0·875. The flask is closed with a rubber stopper carrying a long, narrow tube, and is plunged for 15 minutes into boiling water. The mixture is cooled, filtered, acidified with acetic acid, and the excess of silver estimated by standard sodium chloride (16·2518 grams per litre) taking as the result the mean between the points where silver and a chloride cease to produce turbidity in the clear filtrate.

For estimating tannin, the amount of copper precipitated from a clear, cold solution of cupric acetate (4 grams per litre) is ascertained, both before and after treatment with hide powder, adding in each case an excess of the copper solution and titrating the excess after evaporation with nitric and sulphuric acids. The tannin solution should be diluted to 0·2 per cent. or less, and nearly neutralised with either calcium carbonate or soda. The presence of gallic acid and of metallic salts does not influence the result. Using 20 c.c. of tannin solution, and 20 c.c. of copper in both experiments, and titrating with N/10 alkali, the difference between the number of c.c. of alkali consumed in the two experiments is to be multiplied by 5·1682 to obtain the result in milligrams of tannin. M. J. S.

Volumetric Estimation of Zinc. By Henri Lescœur and Cl. Lemaire (*Bull. Soc. Chim.*, 1895, [3], **13**, 880—882).—In the direct titration of a soluble zinc salt with decinormal barium hydroxide, the state of dilution of the salt greatly affects the result; thus with normal or even decinormal solutions, the results are inexact; with solutions, however, of a less degree of concentration than these, exact numbers are obtained. If, however, the indirect method be employed (adding excess of barium hydroxide, and titrating back), exact results are obtained, independent of the state of dilution.

J. F. T.

Analysis of Galena. By Hugo Eckenroth (*Chem. Centr.*, 1895, ii, 576; from *Pharm. Zeit.*, **40**, 528—529).—0·5 gram of the sample is heated in a 200 c.c. flask with 25 c.c. of hydrochloric acid (sp. gr. 1·12) and 25 c.c. of water until completely decomposed, and the filtrate is then heated with small pieces of zinc until no more hydrogen sulphide is evolved. The spongy lead is dissolved in dilute nitric acid and then estimated as sulphate. L. de K.

Analysis of Alloys of Lead, Tin, Antimony, and Arsenic. By Launcelot Andrews (*J. Amer. Chem. Soc.*, 1895, **17**, 869—873).

—Attempts to remove the tin, antimony, and arsenic by dissolving in nitro-hydrochloric acid and then repeatedly evaporating with fuming hydrochloric acid, were not successful, as the lead chloride remaining was not free from tin and antimony, but the separation was complete when the alloy was heated in a current of hydrogen chloride which had passed through strong nitric acid. Another method consists in distilling the alloy with hydrochloric acid and potassium bromide; tin and lead dissolve, and the arsenic distils, whilst the antimony should remain undissolved; the author found, however, that a little of the antimony dissolves (most likely due to the oxidising action of the air), so that he now uses potassium iodide instead of bromide. The antimony is washed through a Gooch filter with boiling water to remove lead iodide, and then dried. The author prefers converting it into sulphide by fusing it with sulphur in a current of carbonic anhydride before weighing it. L. DE K.

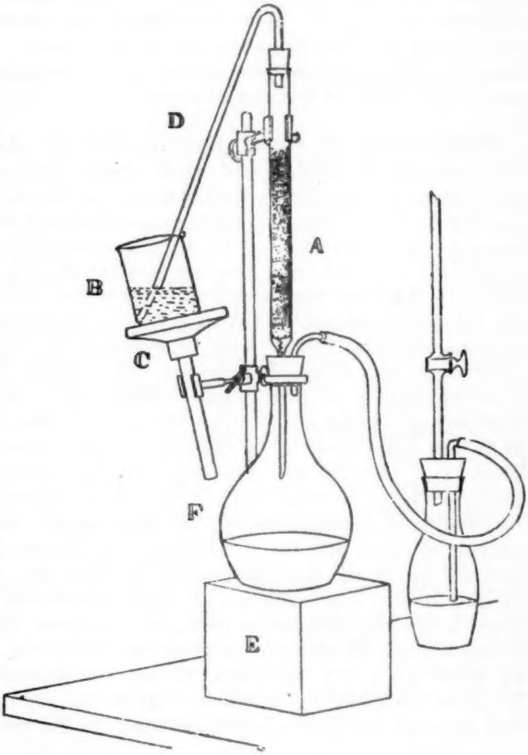
Solution of Ignited Ferric Oxide and other Metallic Oxides. By HUGO BORNTRÄGER (*Zeit. anal. Chem.*, 1896, **35**, 170).—Ignited ferric oxide added to hydrochloric acid in which metallic iron (a weighed quantity of flower wire) is undergoing solution, is reduced by the nascent hydrogen, and dissolves instantly.

Many other metallic oxides behave similarly. M. J. S.

Volumetric Estimation of Titanic acid and Iron in Ores. By HORACE L. WELLS and W. L. MITCHELL (*J. Amer. Chem. Soc.*, 1895, **17**, 878—883).—Five grams of the powdered ore is heated with 100 c.c. (or more) of strong hydrochloric acid. When action ceases, 50 c.c. of dilute sulphuric acid (50 per cent. by vol.) is added, and the liquid evaporated until sulphuric acid fumes make their appearance. When cold, 200 c.c. of water is added, and, as soon as the sulphates have dissolved, the liquid is filtered into a litre flask; any insoluble matter must be fused with potassium hydrogen sulphate, and the solution of the melt added to the main liquid. The liquid is now made up to the mark, and 200 c.c. (1 gram of the sample) is reduced by hydrogen sulphide; when quite reduced, the liquid is boiled to expel the gas, and to avoid contact with air, the flask is covered with a crucible lid. After filling up to the mark with recently boiled water, the contents of the flask are rapidly cooled, transferred to a large beaker, and titrated with permanganate; the precipitated sulphur has no action on the permanganate. The titration is, of course, repeated. Another 200 c.c. is mixed in a 500 c.c. Erlenmeyer flask with 25 c.c. of sulphuric acid, and three or four rods of pure zinc suspended from a platinum wire are introduced; after boiling for 30—40 minutes, a rapid current of carbonic anhydride is passed through, and the contents rapidly cooled. The zinc is now removed, and the solution titrated with permanganate while the carbonic anhydride is still passing. The difference in the two titrations represents the titanic acid. The factor for metallic iron, divided by 0·7, is the one for titanic acid. The results are generally a trifle too low. L. DE K.

Ammonium Phosphomolybdate and the Reducing Action of Zinc in the Reductor. By Andrew A. Blair and J. Edward Whitfield (*J. Amer. Chem. Soc.*, 1895, **12**, 747—760).—The authors have prepared the yellow precipitate in 10 different ways, and investigated its composition. The water was estimated by heating the compound in a current of dry air at 250°, and absorbing the moisture in a weighed calcium chloride tube; the phosphoric acid and the molybdic acid were estimated as usual.

The following is the apparatus used as a reductor (see figure). In the bottom of the reductor tube A, is placed a spiral of platinum wire, on the top of this a piece of platinum gauze, a wad of glass wool 6 mm. thick, and then a thin film of asbestos. The tube is filled with granulated zinc to within 37 mm. of the top, and a wad of glass wool, 12 mm. thick, filling the diameter of the tube, is placed on the top. This serves to distribute the acid, and to prevent the liberated hydrogen from spattering the solution on the upper part of the tube. The solution being placed in the beaker B, the latter is put on the stand C, and the tube D placed in position. The flask F having been attached, the block E is placed under it, and, after connecting with the pump, the liquid is drawn over from B. When it is nearly all drawn over, the sides of the beaker are washed down, and it is then filled with water, and, when this is also drawn over, the stopper carrying the tube D is removed, and the reductor tube is filled with water, to thoroughly wash out the top of the tube. The flask is removed, the end of the reductor tube washed into it, the sides and neck of the flask washed down with water, and the reduced liquid titrated in the flask.



A solution of ammonium molybdate in nitric acid sooner or later deposits a bright yellow precipitate. The authors find this to consist of 90·43 parts of molybdic acid, and 9·61 parts of water. Ammonia was only present in traces; phosphoric acid was absent.

L. DE K.

Estimation of Alcohols and Volatile acids. By EMILE DUCLAUX (*Chem. Centr.*, 1895, i, 1086; from *Ann. Inst. Pasteur*, **9**, 265—280).—The process is intended for the estimation of traces of alcohol and fatty acids formed by the action of bacteria. The liquid is first neutralised, and the alcohol distilled off; its estimation will be the subject of a future paper. The remaining liquid is then acidified with tartaric acid and fractionated. To do this, 110 c.c. of the liquid is distilled, and each separate portion of 10 c.c. is allowed to run into standardised lime water; when 100 c.c. have passed over, the distillation is stopped. The first fractions contain the more volatile acids; the last fractions the less volatile ones. From the amount of lime consumed, the nature of the acid may be determined with the aid of the author's tables and curves.

L. DE K.

Estimation of Fusel Oil in refined Alcohol. By ALBERT STUTZER and R. MAUL (*Zeit. anal. Chem.*, 1896, **35**, 159—162).—The method, save some small modifications, is identical with that described in Abstr., 1891, 622. It is recommended that when the fusel oil does not exceed 0·1 vol. per cent., the first three-fourths of the distillate should be rejected, and the last quarter should be made up with the aqueous distillate and water to double its volume before taking its sp. gr. This should be taken with the minutest accuracy at 15°, in a pyknometer furnished with a verified thermometer (as stopper), graduated to tenths of a degree. The tables of Karl Windisch and that published in *Zeit. anal. Chem.*, **31**, are recommended. The shaking apparatus seems to be the same as that previously described; it differs from that of Windisch (*Arbeit. kaiserl. Gesundheitsamte*, **5**, Part II). It holds 250 c.c. of the diluted spirit and 20 c.c. of chloroform, and can be read to 0·01 c.c. Each apparatus requires to have its constant determined by an experiment with alcohol free from amylic alcohol, which is obtained by fractionating the best commercial spirit of wine, rejecting the first 20 per cent. and the last 60 per cent. The volume of the chloroform is best read at 20°, since a few degrees below this a troublesome turbidity of the alcohol is produced. With pure alcohol, the 20 c.c. of chloroform increased to 20·59 c.c.; 0·1 per cent. of amylic alcohol gave an additional increase of 0·44 c.c., and from 0·01 to 0·2 per cent. of amylic alcohol the increase in volume is proportional to the percentage.

M. J. S.

The Detection of Pentoses by Precipitation with Phloroglucinol and Hydrochloric acid. By BERNHARD TOLLENS (*Ber.*, 1896, **29**, 1202—1209).—When the pentoses are warmed with hydrochloric acid and phloroglucinol, a cherry-red coloration is produced, whilst the solution exhibits a characteristic absorption band, situated on the more refrangible side of the sodium line. When the heating is continued, the solution becomes dark, and this band is obscured, a precipitate being finally formed. The author finds, however, that when the dark-coloured precipitate is filtered off and washed, it may be dissolved in alcohol, and that the solution thus produced exhibits the absorption band quite distinctly. Thus urine containing 1 part of arabinose per thousand did not show the absorption band when placed before the spectroscope, whilst the alcoholic solution of the precipitate obtained by continued heating with the reagents named, showed it clearly. This appears to be about the limit of sensibility of the reaction, which is, however, less delicate in the presence of other sugars. The sugars themselves do not give the reaction at all, although a few of them show slight indications of a band when viewed directly. Pentoses have been detected by the use of this method in various wines, and in the sulphite liquor from the treatment of wood pulp. The urine of a sheep fed on earth-nuts and hay appeared to be quite free from pentoses. A. H.

Estimation of Sugar by the Copper Method. By RUDOLF HEFELMANN (*Chem. Centr.*, 1895, ii, 1091—1092; from *Pharm. Centr. Halle*, **36**, 637—641).—The author recommends collecting the cuprous oxide in a Gooch's crucible, the asbestos lining of which has been freed completely from soluble matter by boiling with aqueous soda and nitro-hydrochloric acid. During the ignition, the bottom part of the crucible is closed by means of a non-perforated platinum lid. Owing to the finely divided state of the cuprous oxide, it burns rapidly and completely to cupric oxide. L. DE K.

Estimation of Crystallisable Sugar in Raw Sugars. By FRIEDRICH STROHMER and A. STIFT (*Chem. Centr.*, 1895, i, 1010; from *Österr.-ungar. Zeit. Zucker-Ind.*, **24**, 41—74).—The authors have investigated Karcz's glycerol process (Abstr., 1895, ii, 93), and describe a special apparatus for drawing off the glycerol from the undissolved sugar.

The conclusion arrived at is that, although scientifically interesting, the process is, as yet, not to be recommended for practical commercial purposes. L. DE K.

Detection of Wood Pulp in Paper. By F. WOLESKY (*Chem. Centr.*, 1895, i, 1086; from *Österr. Ges. Chem. Ind.*, **16**, 119).—One gram of diphenylamine is dissolved in 50 c.c. of alcohol and 5—6 c.c. of strong sulphuric acid, and the sample is immersed in this solution. According to the quantity of wood pulp, a more or less decided orange colour will develop, which increases on drying.

L. DE K.

Estimation of Aldehyde in Spirits of Wine. By LUDWIG MEDICUS (*Chem. Centr.*, 1895, ii, 1060—1061; from *Forsch. Ber. Lebensm.*, **2**, 299—302).—The reagent used consists of 0·5 gram of magenta and 0·5 gram of sulphurous anhydride in 100 c.c. of water. After one to two hours, the liquid is as clear as water. The author prefers using Dubosq's colorimeter, but a couple of glass cylinders of the same diameter will answer the purpose.

The sample is first diluted until it contains from 30 to 50 per cent. of alcohol, and from 10 to 40 c.c. of the reagent is then added to 100 c.c. The mixture is now diluted with *pure* 30 per cent. alcohol until the colour equals that of a mixture containing a known percentage of aldehyde. The results are satisfactory. Minute traces of furfuraldehyde do not interfere.

L. de K.

Critical Temperatures of Solutions: a New Constant for the Identification of Oils, &c. By Léon Crismer (*Chem. Centr.*, 1895, ii, 1059—1060; from *Chem. Rev. Fett u. Harz-Ind.*, 1895, **27**, 1).—A few drops of the oil is introduced into a glass tube 9 cm. long and 5—6 mm. wide. After adding a little 90 per cent. alcohol, the tube is drawn out a few cm. above the surface of the spirit and then sealed. After being tied to a thermometer by means of platinum wire, the tube is heated in a sulphuric acid bath. The meniscus of the oil gradually disappears when the critical point is being reached. After heating another 10°, the thermometer is lifted out, and the source of heat is removed; on shaking the tube, the oil mixes completely with the alcohol; the thermometer is at once replaced in the acid, allowed to cool gradually, and the moment the mixture gets turbid, the temperature is recorded.

The author communicates the critical temperatures of some fats and ethereal oils, which prove that the process is of considerable analytical value. For instance, whilst cotton oil gives the figure 115·5, linseed oil only gives 70; butter varies from 99 to 104, and margarine and ground nut oil from 123 to 124.

L. de K.

The Fatty Oils of Secale cornutum and of the Seeds of Strophantus hispidus and Hyoscyamus niger. By J. Alfred Mjöen (*Arch. Pharm.*, **234**, 278—283, 283—286, 286—289).—The following are some of the analytical results obtained with these oils.

	Secale cornutum.	*Strophantus hispidus.*	*Hyoscyamus niger.*
Specific gravity at 15°	0·9254	0·9285	0·939
Saponification number	178·4	187·9	170·4
Iodine number	71·08	73·02	138·0
Acetyl number	62·9	0·0	0·0
Melting point of fatty acids	39·5—42°	28—30°	—

The oil from *Secale cornutum* contains cholesterol and the glycerides of palmitic and oleïc acids, together with that of a hydroxy-acid which has not been isolated. The two other oils consist mainly of the glycerides of oleïc and palmitic acids, that of *Hyoscyamus niger* also containing the glyceride of another unsaturated acid.

A. H.

Iodine Number and Refractive Index of Cacao Butter. By A. Strohl (*Zeit. anal. Chem.*, 1896, **35**, 166—169).—The very wide limits 32—51 have been found by different investigators. The author, having special facilities for obtaining theobroma kernels from almost all the known sources, has himself extracted the fat from upwards of 40 specimens, and has obtained results varying from 32·8 to 41·7. The refractive indices of the same samples ranged from 1·4565 to 1·4578 at 40°, and showed a certain degree of parallelism with the iodine numbers. M. J. S.

Estimation of Benzidine and Tolidine. By WILHELM VAUBEL (*Zeit. anal. Chem.*, 1896, **35**, 163—164).—Benzidine and tolidine are best estimated by titration with a nitrite. In the commercial substances they are, however, accompanied by other bases which also consume nitrite, but which, in the manufacture of congo dyes, do not yield direct cotton dye-stuffs, although they influence the purity of the colours produced. It is therefore necessary to precipitate the benzidine or tolidine from the hydrochloric acid solution by the addition of sulphuric acid or a sulphate, and to titrate the unprecipitated bases. A correction may be made for the solubility of the sulphates.

	Benzidine.	Tolidine.
1 litre of water dissolves	0·0076 gram.	0·03 gram.
1 litre of water + 20 c.c. of 35 per cent. hydrochloric acid, dissolves	0·02 „	0·513 „
1 litre of water + 50 c.c. of 35 per cent. hydrochloric acid, dissolves	0·48 „	4·42 grams.

Estimations made as above showed 0·2—0·55 per cent. of foreign bases in benzidine, 2·8—5 per cent. in tolidine.

The melting point should not be below 125° for benzidine, or 120° for tolidine (see also Abstr., 1895, ii, 489). M. J. S.

Behaviour of Naphthols and Naphthylamines with Nascent Bromine. By WILHELM VAUBEL (*Zeit. anal. Chem.*, 1896, **35**, 164—166).—This continuation of the author's work (Abstr., 1895, i, 55; 1894, i, 19, 453) has been undertaken with the object of developing analytical methods for the above compounds. The substance was in each case dissolved in glacial acetic acid and treated with a mixture of potassium bromide and bromate with addition of hydrochloric acid.

α-Naphthol rapidly takes up two atoms of bromine, and then further absorption continues more slowly. No sharp end to the reaction can be observed.

α-Naphthol ethyl ether, β-naphthol, β-naphthol methyl ether, and β-naphthol ethyl ether each take up one atom of bromine with sharp end to the reaction, so that the method can be used for their estimation.

Acet-α-naphthylamide and aceto-β-naphthylamide each take up one atom with a termination sharp enough to be recognised, but on adding more of the reagent further bromination slowly takes place.

β-Naphthylamine takes up rapidly more than two atoms, but with no sharp end to the reaction.

α-Naphthylamine behaves somewhat similarly. M. J. S.

The Behaviour of Narcotine and Papaverine in the Stas-Otto Method of detecting the Alkaloïds. By ROBERT OTTO (*Arch. Pharm.*, 1896, **234**, 317—320).—The statement that papaverine is extracted by ether from its solution in aqueous tartaric acid (*Anleitung zur Ausmittelung der Gifte, &c., 6te. Auflage*, 252) was founded on experiments with a sample of so-called papaverine which really consisted mainly of narcotine. The latter is slowly extracted by ether from such a solution, readily from an alkaline solution, whilst papaverine is only extracted in exceedingly small amount from a tartaric acid solution, and not very readily from an alkaline solution. A. H.

Detection of Fatty Oils in Copaiba Balsam: a new Test for Gurjun Balsam. Detection of Colophony in Guaiacum Resin and Balsams of Tolu and Copaiba. By EDUARD HIRSCHSOHN (*Chem. Centr.*, 1895, ii, 694; from *Pharm. Zeit. Russ.*, **34**, 497—499; 499—501; 513—515; 515—517).—The presence of fatty oils in copaiba may be detected by boiling 20—40 drops of the sample with 1—2 c.c. of a solution of 1 part of sodium hydroxide in 5 parts of 95 per cent. alcohol; the solution should not gelatinise on cooling, nor even on adding twice its volume of ether. The sample should also dissolve completely in 3 vols. of 90 per cent. alcohol, and not deposit any oily drops after being at rest for an hour.

To test for gurjun balsam, the sample of copaiba is boiled with 3 vols. of 95 per cent. alcohol and 1 part of crystallised stannous chloride. If the sample is adulterated, it will first turn reddish, and finally blue.

To test guaiacum resin and balsam of tolu for added colophony, the sample is agitated with 4—5 times its bulk of light petroleum, and the filtrate is shaken with its own volume of copper acetate solution (1—1000), when no green colour should be seen in the petroleum layer. To detect the presence of colophony in balsam of copaiba, it has been recommended to triturate the sample with 5 parts of solution of ammonia, and notice whether any gelatinisation takes place. The author, however, finds this test to be untrustworthy.

L. DE K.

Estimation of Jalap Resin in Medicines. Detection of Strychnine in Corpses. By EDUARD SPAETH (*Chem. Centr.*, 1895, ii, 625; from *Forsch. Ber. Lebensm.*, **2**, 224—226).—The medicine containing sugar is mixed with water and whirled in a Soxhlet's centrifugal apparatus. The separated jalap resin is collected, washed with water, dissolved in alcohol, and, after evaporating the latter, the residue is dried over sulphuric acid and weighed. Pills are first extracted with alcohol, the liquid diluted with water, and then treated as above.

The author confirms the statement that strychnine can be satisfactorily detected in corpses which have been buried from two to six months. L. DE K.

General and Physical Chemistry.

Optical Rotatory Power of Substances in the Crystalline and Liquid States. By HERMANN TRAUBE (*Sitzungsber. Berl. Akad.*, 1895, **10**, 195—205).—The author has determined the specific rotations of a number of uniaxial crystalline substances which are circularly polarising, both in the crystalline and the melted or dissolved states.

The hexagonal trapezohedral tetartohedral crystals of patchouli camphor have a rotation for the D line of −1·325° per mm. in the optic axial direction. In the fused state, the camphor has the specific rotation $[\alpha]_D = -118°$, and in alcoholic solution, of $[\alpha]_D = -124·5°$ (Montgolfier, this Journal, 1877, i, 478); these numbers correspond with rotations of −1·240° and −1·308° per mm. respectively of the amorphous substance. It is thus obvious that patchouli camphor has practically the same specific rotation, both in the crystalline and amorphous states. The same is true of ordinary camphor, which crystallises in the same sub-system.

Matico-camphor also crystallises in the hexagonal trapezohedral tetartohedral system, the crystals having a sp. gr. of 1·080 at 15° and a rotation of −1·877° for the D line in plates 1 mm. thick. The melted substance has the specific rotation $[\alpha]_D = -29·17°$, from whence it can be calculated that the rotatory power is about six times as great in the crystalline as in the melted state.

Rubidium tartrate separates from aqueous solution in anhydrous, hexagonal, trapezohedral crystals, having the sp. gr. 2·694 at 14°; $a : c = 1 : 1·82396$; the crystals of the dextrotartrate are lævorotatory, whilst those of the lævotartrate are dextrorotatory. Plates 1 mm. thick have the rotation of 10·12 to 10·24° for the D line; the rotation in aqueous solution, referred to a thickness of 1 mm., is 0·69°, and of the opposite sign to that of the crystals. The author points out that there is nothing unusual in the great differences, both in sign and magnitude of the rotation in the two states, as the sign and magnitude of the specific rotation of a substance depend so much on the solvent. Rubidium racemate crystallises with $2H_2O$ in large monosymmetric plates at low temperatures, but at higher ones is deposited as a mixture of the constituent tartrates. Rubidium and potassium tartrates will not crystallise together as an isomorphous mixture.

Cæsium dextrotartrate is isomorphous with the rubidium salt, $a : c = 1 : 1·80754$; the crystals have the sp. gr. 3·03 at 14°, and a rotation of −14° to −19° per mm. for the D line. The rotation of the crystals is thus of opposite sense to that of the aqueous solution.

W. J. P.

The Dielectric Constant of Liquid Mixtures. By CHARLES E. LINEBARGER, (*Zeits. physikal. Chem.*, 1896, **20**, 131—134).—The dielectric constants were determined in the case of various mixtures of the following:—Benzene | ether; benzene | ethylic acetate; benzene | carbon tetrachloride; toluene | ethylic benzoate; toluene | turpentine; toluene | carbon bisulphide; chloroform | carbon tetrachloride; carbon bisulphide | carbon tetrachloride; carbon bisulphide | chloroform; carbon bisulphide | ether. In no case can the constant be accurately calculated by the simple mixture rule, the actual numbers being lower than the calculated in all cases except in those mixtures where ether was one of the components, when the reverse obtained. The dielectric constants were determined by the method described by Nernst (Abstr., 1894, ii, 437). L. M. J.

Electrolysis of Water. By ALEXEI P. SOKOLOFF (*Ann. Phys. Chem.*, 1896, [2], **58**, 209—248).—According to Helmholtz, the E.M.F. required for the electrolysis of water depends directly on the densities of the hydrogen and oxygen at the electrodes; the smaller these densities the weaker will be the E.M.F. required, and in a liquid from which all gas has been completely removed, the value must sink to zero. Helmholtz has further deduced an expression connecting the E.M.F. of polarisation, A, for any pressures, p_h and p_o, of the hydrogen and oxygen, with the E.M.F. when the pressure p_a is the atmospheric, and determined the value of this last quantity, A_a, as being 1·783 volts. A direct proof that the decomposition of water can be accomplished with any E.M.F., however small, has not yet been given, nor can Helmholtz's determination of A_a be regarded as final; the author has therefore submitted these points to further experimental investigation.

In order to obtain proof of electrolysis when the E.M.F. is very small, a voltameter was arranged, which contained two platinum plates as electrodes, and in the immediate neighbourhood of each plate an insulated platinum point. When a current is passed, the electrodes become polarised by gas layers of definite density, but as these gases are electrically neutral, and therefore quite free, they diffuse through the liquid, and must, in a short time, reach the platinum points and polarise these just as each electrode was originally polarised. This polarisation can then be easily detected by means of a sensitive electrometer. The experiments quoted in the paper, in which this arrangement was employed, show that electrolysis can be produced by any E.M.F. however small.

In contradiction to Helmholtz, the author finds that an E.M.F. of 1 volt suffices to produce gas of measurable pressure by the decomposition of water. Thus, in one experiment, which lasted 16 months, a calomel cell (1·072 volt) produced gas of 2·53 mm. pressure, and from the continual increase in the pressure, this seems to be even far below the limiting value. From the results it appears that difficulties are encountered in producing invisible electrolysis with a small E.M.F., similar to those met with when visible electrolysis is effected. Forces are active on the surfaces of the electrodes which restrain the gases from freely diffusing through the liquid, and bring about absorption of the gases by platinum and other metals.

The forces here spoken of introduce difficulties in the determination of A_a from the results of experiments on visible electrolysis. Determinations which the author has made at low pressures give a value for A_a of 0·745 volt, which is much smaller than that given by Helmholtz. H. C.

New Electrolytic Apparatus. By DONATO TOMMASI (*Compt. rend.*, 1896, **122**, 1122—1123).—The anode consists of a pair of metallic plates or perforated cylinders containing granular metal, &c., whilst the cathode is a metallic disc which revolves between them. Only a segment of this disc is immersed in the liquid, and that part which is above the liquid passes between brushes, which remove both the spongy deposited metal and the bubbles of gas. The metal thus rubbed off is collected in a special form of receiver. By this arrangement, not only is polarisation entirely prevented, but the deposited metal is removed out of danger of subsequent attack by the electrolyte. The resistance of the electrolytic cell is also considerably reduced, because the cathode can be placed very close to the anode, and the agitation caused by the rotating disc maintains uniformity of composition throughout the whole volume of the electrolyte.

C. H. B.

Electrolytic Dissociation in Solvents other than Water. By GIACOMO CARRARA (*Gazzetta*, 1896, **26**, i, 119—195; compare Abstr.,

Substance.	Methylic alcohol.		Water.	
	μ_∞.	$\mu_{1024} - \mu_{32}$.	μ_∞.	$\mu_{1024} - \mu_{32}$.
HCl	133·08	—	395·2	—
HI	134·5	—	397·0	—
LiCl	77·30	18·58	110·0	11·5
KOH	75·75	6·00 ?	237·6	—
KOMe	77·8	—	—	—
KCl	95·57	22·46	140·8	12·6
KBr	96·52	19·72	143·6	12·6
KI	97·63	18·85	142·6	12·2
NaOH	71·83	—	216·2	—
NaOMe	74·5	—	—	—
NaCl	86·80	20·01	119·4	11·9
NaBr	87·57	19·62	122·2	12·0
NaI	89·77	15·78	121·4	15·7
NH_4OH	82·0	—	237·4	30·72
NH_4Cl	96·24	24·78	140·6	—
NH_4Br	99·93	22·32	143·4	—
NH_4I	105·25	20·57	142·6	—
NH_4F	97·6	31·07	121·2	—
NEt_4OH	91·13	—	199·2	—
NEt_4Cl	95·76	20·77	102·4	—
NEt_4Br	96·62	20·01	105·2	11·3
NEt_4I	113·76	34·01	104·2	—
NMe_4I	115·3	39·0	115·6	—
$SMe_3{\cdot}OH$	97·34	—	214·0	—
SMe_3Cl	100·09	27·6	117·8	—
SMe_3Br	102·5	28·9	120·3	—
SMe_3I	116·38	36·65	119·3	—
SEt_3I	112·53	—	107·6	—
$CH_3{\cdot}COONa$	70·32	20·92	87·6	10·5
$CCl_3{\cdot}COOH$	121·48	—	358·0	—
$CCl_3{\cdot}COONa$	73·98	18·96	82·0	9·6

1895, ii, 302).—The author has determined the electrical conductivities of a large number of inorganic and organic salts in methylic alcohol solution. The values of the electrical conductivity at infinite dilution, μ_{∞}, and the differences of the conductivities for the volumes 1024 and 32, $\mu_{1024} - \mu_{32}$, both for methylic alcohol and aqueous solutions, are given in the appended table. The determinations show that methylic alcohol exerts a dissociating effect on most electrolytes comparable to that exerted by water, and the mode of change of the molecular conductivity in the alcoholic solution is quite analogous to that occurring in aqueous solution; it therefore seems justifiable to apply the methods of calculating ionic velocities and limiting values of the molecular conductivity, μ_{∞}, used for aqueous solutions, to solutions in methylic alcohol. No constant ratio exists between the conductivities of solutions of electrolytes in water and methylic alcohol; usually the limiting values are smaller in the latter solutions, but sometimes they are equal to, or even greater than, the molecular conductivities in aqueous solution. In some cases, especially those of tetrethylammonium and trimethylsulphinic hydroxides and iodides, the values of μ_{∞} in the alcoholic solution do not seem to be merely the sums of constant ionic velocities; if the calculated values of μ_{∞} are trustworthy, it consequently follows that the velocity of migration of an ion can depend on the other ion present in solution; quite possibly, however, these calculated values do not correspond to wholly dissociated salts, but only to some definite states of equilibrium at equal concentrations. For the same substance, the degree of dissociation calculated from the rise in boiling point of the solvent, and from the conductivity determinations, are not identical. The law of dilution holding in aqueous solution, seems also to apply in general to solutions in methylic alcohol; Ostwald's formula gives better results for acids and bases, whilst that of Rudolphi answers better for salt solutions. The order of magnitude of the conductivities of the various electrolytes is not the same in aqueous as in methylic alcohol solution.

W. J. P.

Variations of Electrolytic Dissociation with Temperature: Freezing and Boiling Point Determinations of Aqueous and Methylic Alcohol Solutions of Chlorides. By ROBERTO SALVADORI (*Gazzetta*, 1896, **26**, i, 237—254).—The aqueous solutions of many chlorides, such as those of cobalt, nickel, manganese, and copper, change colour as the temperature rises just as they do when concentrated; this fact is usually explained by assuming that heating causes a decrease in electrolytic dissociation just as does an increase in concentration, so that if one or both of the ions differ in colour from the non-dissociated chloride, the colour of the solution changes. The author demonstrates the decrease in dissociation attending rise in temperature by cryoscopic and ebullioscopic determinations with aqueous solutions of the above chlorides; the degree of dissociation found by the cryoscopic method is always greater than that shown at the higher temperature by the boiling point method.

The degree of dissociation calculated from the rise in boiling point of methylic alcohol solutions of the chlorides is much less than in aqueous solutions; this is especially the case with cobalt chloride, which, judging by the colour of the alcoholic solution, should be much more highly dissociated. Mercuric chloride is more highly dissociated in methylic alcohol than in water; Beckmann (Abstr., 1891, 389) has shown that this chloride is dissociated to a less extent by ethylic alcohol than by water. W. J. P.

Thermo-elements of Amalgams and Electrolytes. By August Hagenbach (*Ann. Phys. Chem.*, 1896, [2], **58**, 21—36).—The author determined the thermo-electromotive force for elements consisting of the following chain: Cadmium amalgam | solution of a cadmium salt | cadmium amalgam, and of a similar chain for lead. The sulphate, nitrate, chloride, bromide, and iodide of cadmium, and the nitrate and chloride of lead were employed at various concentrations. One electrode was maintained at a temperature of about 6°, and readings taken with the second electrode at temperatures ranging from 6° to 80°. The thermo-electromotive force was found to be approximately proportional to the temperature, except for lead chloride, where it remained almost constant from 30° to 50°, whilst, contrary to expectation, the E.M.F. decreases with increasing dilution, the decrease varying with the different salts. L. M. J.

Thermochemistry of Nickel Cyanide. By Raoul Varet (*Compt. rend.*, 1896, **122**, 1123—1125).—The heat of formation of nickel cyanide was measured by precipitating nickel sulphate solution with potassium cyanide and sodium cyanide solutions, and also by treating nickel nitrate solution in a similar manner. The different determinations agree closely, and the mean result is

Ni sol. + 2CN gas + nH$_2$O liq. = Ni(CN)$_2$ pptd. hydrated .... develops +50·5 Cal.

Measurements of the heat of dissolution of nickel cyanide in solutions of cyanides of the alkalis or alkaline earths gave the following results.

Ni(CN)$_2$ pptd. + 2KCN diss. = Ni(CN)$_2$, 2KCN diss. .... develops +12·4 Cal.
Ni(CN)$_2$ pptd. + 2NaCN diss. = Ni (CN)$_2$, 2NaCN diss. .... „ +12·3 „
Ni(CN)$_2$ pptd. + Ba(CN)$_2$ diss. = Ni(CN)$_2$, Ba(CN)$_2$ diss. .... „ +12·4 „
Ni(CN)$_2$ pptd. + Sr(CN)$_2$ diss. = Ni(CN)$_2$, Sr(CN)$_2$ .... „ +12·6 „

These results show that the soluble so-called double cyanides (which are not dissociated by dialysis) may be regarded as derived from a complex nickelocyanic acid, which, however, seems not to exist in the free state. C. H. B.

Adiabatic Volume Changes in Solutions. By K. Rogóyski and Gustav Tammann (*Zeits. physikal. Chem.*, 1896, **20**, 1—18).—By the application of the gaseous expression connecting the coefficient of expansion, specific heat, and temperature change for adiabatic compression, to the case of liquids where the external work is negligeable, the equation $d_QT/dp = T/C_p \,.\, d_pv/dT$ is obtained, which, by integration and the expression of C_p in calories, yields

$$\Delta_QT = \int_{p_1}^{p_2} T/Ec_p \,.\, dv/dT \,.\, dp.$$

Necessary data for dv/dT and C_p as functions of p are obtained from Amagat's numbers, and the values of Δ_QT are calculated for pressures from 100 to 2,000 atmospheres at 0°, formulæ for other temperatures being also given, the results agreeing fairly well with existing data. By the substitution of $p + \Delta\kappa$ for p, the equation is applicable to solutions, $\Delta\kappa$ being the internal pressure of the solution. By measurements of the resistance and use of the known temperature coefficients, the temperature changes for the release of compression are determined for solutions of potassium chloride, sodium chloride, zinc sulphate, sulphuric acid, and sodium chloride in dilute ethylic alcohol. The results are compared with those theoretically calculated, and show throughout a very satisfactory agreement, although, in the authors' opinion, the differences are greater than the experimental errors (see also this vol., ii, 289; Abstr., 1895, ii, 307, and previous abstracts). L. M. J.

Dissociation of Halogen Salts. By ALEXANDR A. JAKOWKIN (*Zeits. physikal. Chem.*, 1896, **20**, 19—39).—In the author's previous communication on the dissociation of potassium triiodide (Abstr., 1894, ii, 271), the value of the constant was determined, assuming the partition ratio between carbon bisulphide and water to be 410/1, whereas the author has since determined this ratio to be 680—585 (this vol., ii, 295). The previous results are, therefore, recalculated, the dissociation constant being found to vary only very slightly; to be greater for potassium tribromide than for the triiodide, and greater for the potassium than for the hydrogen salts. As I_3 exists as an independent ion, the dissociation in dilute solutions should be independent of the metallic ion, a conclusion verified in the case of lithium, sodium, potassium, and barium iodides. As the coefficient of absorption is altered by the solution of other salts, the partition ratios of bromine, and iodine in carbon tetrachloride, and carbon bisulphide, and various salt solutions were determined, and in these cases Setchenoff's absorption law is found to hold good. The dissociation of various mixed halogen salts in water and salt solutions were also examined. In the case of the bromide, the results indicate the probability of the formation of higher halogen compounds, such as KBr_5, at higher concentrations. L. M. J.

Freezing of Dilute Solutions. By I. ZOPPELLARI (*Gazzetta*, 1896, **26**, i, 116—118).—The fact that on cooling a dilute solution, the pure solvent solidifies first, whilst the dissolved substance becomes concentrated in the residual solution, may be well demonstrated by cooling a 0·03 per cent. aqueous solution of potassium permanganate contained in a small beaker at −5°; after some hours the beaker is found to be lined with colourless ice, whilst the deeply coloured liquid core of the mass retains all the permanganate in solution. W. J. P.

Cryoscopic Behaviour and Composition of some Acetates of Feeble Bases. By I. ZOPPELLARI (*Gazzetta*, 1896, **26**, i, 255—264; compare Ghira, Abstr., 1893, i, 667; 1894, i, 226).—The author has analysed and examined the cryoscopic behaviour in benzene solution of the acetates of piperidine, diisoamylamine, diisobutylamine, coniine, dipropylamine, and phenylhydrazine; these salts all consist of one molecule of base to one of acid with the exception of the last, which contains two molecules of acid. Picoline acetate depresses the freezing point of benzene normally, but the ethylaniline salt gives a very large molecular depression, just as Ghira found with the acetates of aniline and diethylaniline; dipropylamine acetate gives a very low molecular depression, whilst phenylhydrazine acetate gives the normal depression in a 3 per cent. solution, and a very large molecular depression in a 0·6 per cent. solution. The high molecular depressions found with the acetates of aniline and its alkyl derivatives are the sums of those due to the base and to the acid, showing that the salts are dissociated in benzene; the very low molecular depressions obtained with the acetates of diethylamine, coniine, dipropylamine, diisoamylamine, and piperidine may be due either to doubling of the molecule, or to the formation of acid acetates in benzene solutions. A comparison of the molecular depressions of the freezing point of benzene by these salts with the affinity constants K of the bases reveals an intimate connection; the molecular depression decreases regularly as the affinity constant becomes greater. W. J. P.

Reaction Velocity in the Conversion of Diazoamido- into Amidoazo-derivatives. By HEINRICH GOLDSCHMIDT and R. U. REINDERS (*Ber.*, 1896, **29**, 1369—1377).—The object of this investigation was to determine the influence of temperature, solvent, and quantity of reacting substances on the reaction velocity in the conversion of diazoamido- into amidoazo-compounds; light might also be thrown on the part played by the catalytic agent. The present communication is confined to the investigation of the action of aniline hydrochloride on diazoamidobenzene in aniline solution; the statement frequently made that the hydrogen chloride converts the diazoamidobenzene into diazobenzene chloride and aniline, and that these then combine, forming amidoazobenzene, is incorrect, since solid diazobenzene chloride and aniline or paratoluidine first yield diazoamido-derivatives, which are only slowly converted into amidoazo-compounds.

The aniline (25 or 50 grams) was weighed into corked flasks, the necessary quantity of aniline hydrochloride dissolved in it, and the flasks heated in a water bath of constant temperature; diazoamidobenzene was then added, and, after the requisite time had elapsed, a portion of the mixture was withdrawn and the reaction arrested by the addition of soda. The analysis of the product is based on the fact that diazoamidobenzene, when heated with dilute acid, evolves two-thirds of its total nitrogen, whilst amidoazobenzene is not changed under these conditions. The nitrogen was evolved and collected in an apparatus designed by the authors, and which is fully described. Hempel's burette was not found to be convenient. The velocity constant, K, was calculated from the formula $K = \frac{l}{t} \log \frac{a}{a-x}$, where t = the time in hours.

Influence of the Concentration of the Aniline Hydrochloride Solution on the Velocity Constant.—Aniline hydrochloride, 0·1, 0·2, 0·3 parts in 1,000 of aniline, K = 0·0060, 0·0123, 0·0181 respectively, whence it follows that, as in many monomolecular reactions, K is proportional to the concentration of the catalytic agent.

Influence of Temperature.—The value of K at 25°, 35°, 45°, and 55° = 0·0060, 0·0246, 0·0810, and 0·2530 respectively, the values calculated by means of van't Hoff's expression, $\log K = -\frac{A}{T} + B$, using the known values at 25° and 45°, are 0·0231 and 0·2640 for 35° and 55° respectively.

Concentration of the Diazoamidobenzene.—As normal solution, one containing in 1000 grams aniline, 0·5 gram-molecule of diazoamidobenzene, was employed; the temperatures selected were 35° and 55°, for $N\frac{1}{2}$ solutions, $K_{0\cdot1}$ = 0·0246 and 0·2530 respectively; for $N\frac{3}{4}$ solutions the values are 0·0250 and 0·2640 respectively. For solutions of moderate strength, the concentration of the diazoamidobenzene is practically without influence on the velocity of the reaction. The directions, found by practice to give the best yield of amidoazobenzene, and given by E. Fischer in his "Organischer Präparate," are almost identical with the conditions which calculation from the above values indicates as the most favourable. J. B. T.

A new form of Mercury Air-pump. By R. W. Wood (*Ann. Phys. Chem.*, 1896, [2], **58**, 205—208).—The author describes a form of mercurial pump intended chiefly for the production of Röntgen vacuum tubes. Diagrams of the instrument, with the method of use, are given. L. M. J.

Automatic Apparatus for Filtration at High Temperatures. By J. J. Postoéeff (*Chem. Centr.*, 1895, ii, 1—2; from *Wratsch*, 1895, 182).—The apparatus consists of a hot water funnel of the usual construction. The steam escaping from the jacket is conducted, by means of a rubber tube, to a flask which, together with the burner used for heating, is fixed on a revolving lever attached to the base of the tripod which carries the funnel. The lever is kept in position by a counterpoise, but when a given quantity of water has condensed in the flask, the lever turns, and thus removes the burner from below the heating jacket. As the funnel cools, it draws the water back out of the flask, the lever turns, and brings the burner into position again. In cooling, the temperature falls 2—3°, and the apparatus can be left to itself for 24 hours. J. J. S.

Inorganic Chemistry.

Electrolytic Formation of Hypochlorites and of Chlorates. By FELIX OETTEL (*Chem. Centr.*, 1895, i, 592—593; from *Zeits. Elektrotechn. u. Elektrochemie*, 1895, 354—361, and 474—480).—The electrolysis of potassium chloride solutions was studied with the following apparatus. The current was obtained from four accumulators; in the circuit were arranged a copper voltameter for measuring the current, a voltameter for collecting the electrolytic gas, the cells in which the experiments were carried out, an ampère meter, and a resistance box. The gas voltameter was filled with caustic soda solution, and was provided with electrodes consisting of two concentric cylinders of nickel foil. The cell in which the actual experiments were performed had a capacity of about 115 c.c., and was closed by a sheet of rubber closely screwed down; through the rubber passed the electrodes (platinum foil and wire), a capillary delivery tube, and an ordinary glass tube reaching to the bottom of the cell and serving to empty or fill it. A current of 1—1·2 ampère was used, and was allowed to run for two hours. When neutral solutions are electrolysed, the main product is hypochlorite. At the end of the experiment 83 per cent. of the active chlorine exists as hypochlorite and 17 per cent. as chlorate. The addition of an alkali favours the decomposition of the water, and decreases the amount of hypochlorite formed, but increases the amount of chlorate. Raising the temperature has pretty much the same influence as the addition of alkali.

A less dense current at the cathode favours the reduction of hypochlorite, and has the greatest effect in a concentrated solution, either neutral or slightly alkaline; a diminution in the density of the current at the anode increases the amount of water decomposed; the difference is less marked in a strongly alkaline solution.

In an alkaline solution, the reduction is reduced to a minimum, and hence it is not necessary to use a diaphragm (membrane).

Sodium chlorate can be obtained in a similar manner; sodium hydroxide increases the amount of chlorate formed, even more than potassium hydroxide. J. J. S.

Manufacture of Potassium Chlorate. By K. J. BAYER (*Chem. Zeit.*, 1895, **19**, 1453—1455).—The author describes a new method for the manufacture of potassium chlorate. Chlorine is lead into a cream of zinc oxide and water; zinc oxychloride and hypochlorite are first formed, but, finally, a clear solution of zinc chloride and hypochlorite is obtained. The conversion of the hypochlorite into chlorate readily takes place when this solution is heated with the requisite quantity of potassium chloride, and the yield is almost theoretical. A still better method is to add the requisite quantity of potassium chloride to the zinc oxide and water before the chlorine is passed in, and then to keep the temperature at about 90—95° during the chlorination. The resulting solution may be evaporated down to 30° Bé., when, on cooling, the greater part of the potassium chlorate crystallises out in nearly pure form. A further quantity may be obtained by concentrating the mother liquors to 60° Bé.

The final mother liquor is treated with hydrochloric acid, and then evaporated down till the zinc chloride solidifies. The mode of working and the appliances used are almost identical with those employed in the manufacture of potassium chlorate by the lime method.

J. J. S.

The Density of Oxygen. By Edward W. Morley (*Zeits. physikal. Chem.*, 1896, **20**, 68—130).—Three series of determinations were made. In the first of these all necessary corrections were applied; in the second corrections for the expansion of the glass and thermometric corrections were eliminated as the gas was brought into pressure and temperature equilibrium with a similar flask containing the normal volume of hydrogen; whilst in the third series the temperature was throughout the experiment that of melting ice. The capacity of the flasks, internal, and external, were determined by (1) weight in air, (2) additional weight to maintain equilibrium, when the flask was immersed in water; (3) loss of weight when filled with water and weighed in water of equal temperature. The oxygen employed was prepared from potassium chlorate, and also in the third series by electrolysis, and every precaution observed to ensure purity. The author estimates the quantity of nitrogen present to be not more than 1/30,000, and of chlorine not more than $\frac{1}{20}$ milligram in 20 litres, whilst the carbonic anhydride, and mercury vapour are also quite negligeable. The details of the apparatus used, of the filling and evacuation of the flasks, &c., and the experimental numbers are given in the paper. The agreement of the several experiments indicate the very great care with which the determinations were made, the final results being

$$(1).\ D = 1{\cdot}42879 \pm 0{\cdot}000034 \text{ (mean of 9).}$$
$$(2).\ D = 1{\cdot}42887 \pm 0{\cdot}000048 \text{ (mean of 15).}$$
$$(3).\ D = 1{\cdot}42917 \pm 0{\cdot}000048 \text{ (mean of 24).}$$

The author considers that of these the third should receive double weight, and hence obtains as a mean of the whole series D = 1·42900 ± 0·000034 (Abstr., 1895, ii, 261).

L. M. J.

Tubular Ozone Generator. By Gaston Séguy (*Compt. rend.*, 1896, **122**, 1120—1121).—Each generator consists of a glass tube containing seven narrow tubes, each of which has a spiral of aluminum wire inside and outside. The inside spirals are all connected with a single wire which passes to the outside of the large tube, whilst the external spirals are similarly connected with another wire. These wires are respectively connected with the two poles of an induction coil. Three or more of the generators may be connected in series, and 170 milligrams of ozone per hour can be obtained from air, and 250 milligrams per hour from oxygen.

C. H. B.

Formation of Persulphuric acid. By KARL ELBS and O. SCHÖNHERR (*Chem. Centr.*, 1895, i, 591—592; from *Zeits. Elektrotechn. u. Electrochemie*, 1895, 417—420 and 468—472).—The authors have determined the relationship between the amount of persulphuric acid formed, and the concentration of the sulphuric acid which is electrolysed. The persulphuric acid was estimated by pouring 5—10 c.c. of the liquid into 200—300 c.c. cold water, adding a given quantity of ferrous ammonium sulphate and titrating back with potassium permanganate. If the density of the sulphuric acid is below 1·2, very little persulphuric acid is formed; the maximum amount is obtained when the acid has a sp. gr. = 1·35—1·5. The persulphuric acid is formed by the union of HSO_4 ions at the anodes, and is not due to oxidation, since the amount formed is greater with a stronger current, whereas if it were a simple oxidation product the amount formed would decrease with an increase in the strength of the current. Too great a concentration of the acid retards the formation of persulphuric acid for several reasons:—(1) Concentrated acid is a bad conductor; (2) the molecules of $H_2S_2O_8$ when formed in a concentrated acid are not so free to move as in the more mobile dilute acid, and hence remain a longer time at the anode and become decomposed; (3) with concentrated acid, the amount of heat developed is greater and hence destroys a greater number of persulphuric acid molecules.

When a strong current is passed through a moderately dilute acid, it is broken. On warming, however, the electrolysis begins anew. This stoppage is caused by the accumulation of too many ions, and the formation of a coating of the non-conducting $H_2S_2O_8$ molecules round the anode.

The amount of persulphuric acid formed is also diminished by increase of temperature; at 60° it is decomposed as rapidly as formed. With dilute acid (sp. gr. $< 1·3$) practically no hydrogen peroxide is formed by the decomposition of the persulphuric acid, the amount of peroxide, however, increases with the strength of acid.

When diluted with 50 times its volume of cold water, persulphuric acid is not decomposed. J. J. S.

Persulphuric acid. By KARL ELBS (*Chem. Centr.*, 1895, ii, 476—477; from *Zeits. Electrotechn. u. Electrochemie*, 1895, 162—163). —In order to demonstrate the formation of persulphuric acid and of its potassium salt, a wide test tube is filled with the electrolyte, the anode being a platinum wire enclosed for the greater part of its length in a glass tube, and the cathode a platinum ring. A wider tube, surrounding the anode, collects the bubbles of gas evolved and prevents their reaching the cathode. The whole apparatus is placed in a beaker of cold water. A current of 100 ampères per square metre anode surface is used. With sulphuric acid of sp. gr. 1·4, persulphuric acid can be detected in the liquid round the anode after five minutes. With a cold saturated solution of potassium sulphate in dilute sulphuric acid, a considerable amount of crystallised potassium persulphate is obtained at the end of 10 minutes. The ammonium salt requires a longer time. The same apparatus may be used for showing the conversion of cobaltous into cobaltic salts. The author also proves that Darrieus and Schoops' hypothesis of lead accumulators (compare *Chem. Centr.*, 1895, i, 522) is not tenable; since lead dioxide is only formed by persulphuric acid in nearly alkaline solutions. J. J. S.

Position of Tellurium in the Periodic System. By JAN W. RETGERS (*Zeits. anorg. Chem.*, 1896, **12**, 98—117).—A controversial paper dealing with the results published by Staudenmaier (this vol., ii, 96). E. C. R.

Hyponitrous acid. By ARTHUR R. HANTZSCH (*Ber.*, 1896, **29**, 1394).—The author in conjunction with Ludwig Kaufmann, has prepared hyponitrous acid in the solid form, together with an ethereal salt and the ammonium salt. Further details will shortly be published. (Compare Tanatar, this vol., ii, 417.) A. H.

Action of Hydrogen Bromide on Thiophosphoryl Chloride. By ADOLPHE BESSON (*Compt. rend.*, 1896, **122**, 1057—1060).—Carefully purified thiophosphoryl chloride melts at −35°. It is not attacked at its boiling point by hydrogen bromide, but if the gas mixed with vapour of the thiophosphoryl chloride is passed over pumice heated at 400—500°, decomposition takes place, and the product contains the three derivatives, $PSCl_2Br$, $PSClBr_2$, and $PSBr_3$, which can only be separated by careful fractionation under low pressure.

Thiophosphoryl bromodichloride, $PSCl_2Br$, boils at about 80° under a pressure of 6 mm.; sp. gr. = 2·12 at 0°. When strongly cooled, it forms a white solid, which melts at −30°. It decomposes slowly in presence of water, more rapidly in contact with solutions of alkalis. Fuming nitric acid oxidises it violently, but the acid of 36° acts more slowly, and completely oxidises the sulphur and phosphorus. When heated at 100°, it decomposes into the thiophosphoryl trichloride and the chlorodibromide, the latter, in its turn, decomposing and yielding, amongst other products, thiophosphoryl tribromide.

Thiophosphoryl chlorodibromide, $PSClBr_2$, boils at about 95° under a pressure of 60 mm., and has properties very similar to those of the preceding compound. When solidified it melts at −6°; sp. gr. = 2·48 at 0°. C. H. B.

Isolation of Lithium and of Beryllium. By WILHELM BORCHERS (*Chem. Centr.*, 1895, ii, 13—14; from *Zeits. Elektrotechn. u. Elektrochemie*, 1895, 39—40).—In the treatment of minerals containing lithium, the solution of the chlorides of the alkalis and alkaline earths is made slightly alkaline and evaporated in an iron vessel, then fused with ammonium chloride to render it neutral, and electrolysed with a current of 1,000 ampères per square metre of cathode surface and 5 volts. The upper rim of the iron crucible is kept cool by the circulation of cold water, and a thin crust of solid material is formed on the surface, which prevents the metallic lithium from coming into contact with the atmosphere. The metallic globules are placed in a paraffin bath at 130—200°, when the pure metal rises to the surface.

Beryllium chloride solutions are evaporated down with an alkali chloride and ammonium chloride, and then electrolysed in the same manner as magnesium chloride. Calcium and magnesium chlorides must not be present. The temperature must also be kept as low as possible, as otherwise the beryllium forms an alloy with the iron of the crucible. J. J. S.

Electrolytic Silver Peroxide. By OTTOKAR ŠULC (*Zeits. anorg. Chem.*, 1896, **12**, 89—97).—The author has investigated the black deposit consisting for the most part of silver peroxide, which is formed during the electrolysis of silver nitrate between platinum electrodes. A platinum dish is employed as the cathode, whilst the anode consists of a piece of platinum foil cut in the form of a comb, and then rolled up. A 15 per cent. silver nitrate solution is employed, and a current of 0·06 ampère, the density at the cathode being 0·0033 ampère per centimetre. The electrolysis is allowed to continue for 3—4 hours; the silver solution, which has become contaminated with about 4 per cent. of free nitric acid, is then removed, and the electrolysis again continued. The crystalline deposit on the anode is brushed off with a glass rod and washed with water until the wash-water gives no opalescence with hydrochloric acid. The product, on analysis, gave numbers agreeing with the formula Ag_7NO_{11}. It forms beautiful, black octahedra, having a metallic lustre and a sp. gr. = 5·65. It is fairly stable in dry air at the ordinary temperature, and loses its lustre only after remaining some months. When quickly heated, it decomposes into a voluminous, dark brown powder, with evolution of oxygen, and this decomposition takes place with the crystalline compound at 155°, with the powdered compound at 162°. At an incipient red heat, a further decomposition takes place, red fumes are evolved, and metallic silver is formed. It is only slightly decomposed by water at ordinary temperatures, and after some time silver nitrate goes into solution; when boiled for 1½ days with water, the silver is deposited in the form of a mirror. When boiled with alcohol, aldehyde is formed and a mirror deposited, and if a small quantity of ammonia is added, a very beautiful mirror is obtained. It is completely decomposed by oxalic acid, with evolution of carbonic anhydride, and by ammonia, with evolution of nitrogen. It dissolves in nitric acid with a dark brown coloration, and in sulphuric acid with a dirty green coloration; both solutions go colourless on heating, diluting, and on remaining. The oxygen evolved during the first decomposition which takes place, on heating, is 7·69 per cent. The percentage of nitrogen (1·40 per cent.) corresponds with a percentage of silver, as $AgNO_3$, of 12·61, and this agrees with the analysis of the residue obtained by decomposing the product with hot water. Whence the author deduces the formula $3Ag_2O,AgNO_3$. E. C. R.

Experiments with Silver Sulphide. By THEODOR GROSS (*Chem. Centr.*, 1895, ii, 353—354; from *Elektro-chem. Zeits.*, 1895, 80—81).—Silver sulphide, when brought into contact with a platinum cathode in dilute sulphuric acid, is converted into a grey mass, the gas evolved from the cathode yields, with silver nitrate solution, a greyish-black precipitate consisting of glistening plates. A similar precipitate is obtained by treating silver nitrate with electrolysed sulphuric acid. Both precipitates differ from silver sulphide, Ag_2S, in properties. The author has treated the precipitate with nitric acid, and then fused it with potash, when decomposition ensues, but its constitution has not been determined.

Silver sulphide, mixed with 3—4 times the amount of silver nitrate, then with nitric acid (sp. gr. 1·4), and evaporated to dryness and ignited, also yields a grey mass, which the author has treated with nitric acid and other reagents with no definite results (compare this vol., ii, 472). J. J. S.

Crystals produced in the Dephosphorisation of Iron. By ADOLPHE CARNOT (*Ann. des Mines*, 1895, [9], **8**, 300—310; compare Abstr., 1884, 157, 520).—In the basic slags produced in the Thomas-Gilchrist process the following kinds of crystals have been found: (1) brown rectangular (orthorhombic) tablets with the composition $P_2O_5,4CaO$; (2) brown and black hexagonal needles of much the same composition, but with 3—4 per cent. of silica; (3) brilliant, blue, orthorhombic crystals with the formula $P_2O_5,SiO_2,5CaO$ or $P_2O_5,3CaO + SiO_2,2CaO$. Hilgenstock has supposed these to be trimorphous, but the differences in composition, especially as regards silica, are against this view. A new analysis has been made of the first kind of crystals, which were obtained from the basic slags of Kladno, Bohemia.

P_2O_5.	SiO_2.	CaO.	MgO.	FeO.	Al_2O_3.	Total.
37·67	0·74	59·54	trace	1·44	0·37	99·76

This analysis is compared with that of similar crystals from Middlesbrough examined by Stead and Ridsdale (Trans., 1887, 601). L. J. S.

Reduction in Neutral Solutions. By CARL KIPPENBERGER (*Chem. Zeit.*, 1895, **19**, 1269—1270).—The author has studied the action of pure metals on carbonic anhydride solution in the absence of acids, and also on metallic carbonates, his results confirm those already published by Lieben (Abstr., 1895, ii, 348). Powdered magnesium has the power of decomposing a solution of magnesium sulphate, a quantity of magnesium hydroxide corresponding with the amount of magnesium originally in solution as sulphate, is precipitated, and the metallic magnesium which was added dissolves with evolution of hydrogen. Metallic lead has a very similar action on a solution of lead nitrate. In the case of those metals whose oxides are readily reduced, no free hydrogen escapes, it being used up in the nascent states in the reduction of the metallic oxide; in other cases it is used up in the reduction of the acid radicle. For example, when metallic magnesium decomposes a solution of lead nitrate, a small quantity of hydrogen is evolved, but the greater part is used up in the reduction of the lead hydroxide and of the nitric acid.

When a metal is added to a solution of an acid salt, the excess of acid is first decomposed, and then the acid formed by the ionisation of the normal salt. A good example of this is the decomposition of a bicarbonate solution by means of aluminium. The author states that the chemically active carbonic acid has the formula H_2CO_3 (compare Lieben, *loc. cit.*); under certain conditions small quantities of formaldehyde and formic acid can be obtained in the reduction of carbonic acid.

Magnesium, aluminium, and zinc readily reduce solutions of nitates and chlorates. In a dilute solution of a nitrate, the first reduction product is a nitrite, then hydroxylamine, and finally ammonia; these primary reduction products can, however, interact with one another to yield secondary reduction products, such as nitrous oxide, nitric oxide, nitrogen, water, &c. A chlorate is first reduced to a chlorite, but this is immediately decomposed into chloride and chlorate; this chlorate is again reduced in a similar manner, so that the final product consists almost entirely of chloride.

J. J. S.

Lead Sulphiodide. By VICTOR LENHER (*J. Amer. Chem. Soc.*, 1895, **17**, 511—513).—When hydrogen sulphide is added to a solution of $PbI_2,2KI$, or of $PbI_2,4KI$, in potassium iodide, a brick-red coloured precipitate is obtained; on addition of more hydrogen sulphide, the precipitate changes through dark red to brown, and finally to the black sulphide. The red precipitate was obtained pure on the addition of a saturated hydrogen sulphide solution to a strong solution of lead iodide in a saturated solution of potassium iodide. The precipitate was filtered, washed with a saturated solution of potassium iodide, then thoroughly with cold water, afterwards with absolute alcohol, with carbon bisulphide to remove any sulphur, and again with alcohol, and finally dried by drawing air over it. The substance has a great tendency to decompose into lead sulphide and lead iodide, and it is advisable to prepare only small quantities at a time. The composition is represented by the formula $PbS,4PbI_2$.

It is readily decomposed by heat, acids, alkalis, and even by long exposure to light. J. J. S.

Enamel. By OSKAR EMMERLING (*Ber.*, 1896, **29**, 1549).—Most of the enamels used for coating iron contain silica, boric acid, alumina, and alkalis, and, if white in colour, stannic oxide. A sample of French manufacture has been found to have the percentage composition:—SiO_2, 36·69; PbO, 52·51; K_2O, 6·33; Na_2O, 0·60; As_2O_5, 3·74; CoO, traces; the white appearance being obtained by means of lead arsenate instead of stannic oxide. Such an enamel is readily attacked, even by dilute acids, and is obviously not to be recommended for culinary utensils. C. F. B.

Reduction of Copper Sulphide. By DELIA STICKNEY (*Amer. Chem. J.*, 1896, **18**, 502—504).—Copper sulphide is nearly completely reduced to copper when heated in contact with the flame of a Bunsen burner. A. G. B.

Action of Nascent Iodine on Mercuric Chloride. By M. C. SCHUYTEN (*Chem. Zeit.*, 1895, **19**, 1683).—In order to study the action of nascent iodine on mercuric chloride, the author has treated the chloride with an ethereal solution of iodoform. The two were used in molecular proportion, and were left in contact for several days in loosely stoppered bottles. Brilliant, red, octahedral crystals of mercuric iodide were obtained in almost theoretical quantity. The yield is much smaller when the iodine is not in the nascent state.

J. J. S.

Barium Tetrachromite. By E. DUFAU (*Compt. rend.*, 1896, **122**, 1125—1127).—Equal weights of chromic oxide and barium oxide are intimately mixed and heated in a crucible brasqued with barium oxide in the electric furnace in an arc from a current of 50 volts and 300 ampères for 10 minutes. The fused product, after cooling, is repeatedly treated with hydrochloric acid, and the residue is a mixture of green lamellæ of chromic oxide, and small, brilliant, black crystals of *barium tetrachromite*, $BaO,4Cr_2O_3$, which can be separated by levigation. The crystals of the tetrachromite seem to belong to the hexagonal system, and are slightly harder than quartz; sp. gr. = 5·4 at 15°.

The tetrachromite is very stable, and is slowly attacked by chlorine or bromine at a bright red heat, with formation of a barium salt and chromic oxide; iodine seems to have no action under these conditions. Water vapour at a bright red heat, and sulphur at the softening point of glass, are without action, and the tetrachromite is also not attacked by hydrofluoric, hydrochloric, nitric, and sulphuric acids. It is, however, slowly decomposed by dry hydrogen fluoride or hydrogen chloride at a red heat.

The tetrachromite is readily converted into chromate, the change taking place with incandescence in oxygen below a red heat, and also, though slowly, in air. Fused oxidising agents and alkali hydroxides and carbonates produce a similar result. C. H. B.

Behaviour of Aluminium with Ammonium Compounds. Method of producing Chemical Change on the surface of Commercial Aluminium. By CHRISTIAN GÖTTIG (*Ber.*, 1896, **29**, 1671—1673).—Aluminium dissolves with comparative readiness in ammonia, provided the solution is sufficiently dilute, the evolution of hydrogen being readily perceptible in solutions containing only 0·025 per cent. of ammonia; the ammonium aluminate which is first formed is unstable and readily decomposes into aluminium hydroxide and ammonia. The addition of ammonium salts, or of a little acid, facilitates the solution of the metal, but in this case there is little or no evolution of hydrogen, and the surface of the metal is lighter than when ammonia alone is employed. The other constituents of commercial aluminium are not acted on by ammonia, and consequently the surface of any aluminium object, treated as above, is less readily affected by chemical or mechanical agents than the original metal. J. B. T.

Chromium Salts. By Willis R. Whitney (*Zeit. physikal. Chem.*, 1896, **20**, 40—67).—The cause of the colour change in solutions of chromium sulphate was investigated, (1) by the alteration of conductivity on the addition of sodium or barium hydroxide, (2) by the action of the salt in effecting hydrolysis of methylic acetate. The first series of experiments indicate that one-sixth of the sulphate in the green solution is present as free sulphuric acid, and one-third as SO_4 ions, a result agreeing with Recoura's conclusion that the salt $[Cr_4O(SO_4)_4]SO_4$ is formed during the colour change. The catalytic experiments show that the green solution possesses a hydrolysing power equal to that of a mixture of one-sixth the equivalent of free acid with the corresponding amounts of the violet salt. The electrical conductivity of chromo-monosulphuric, -disulphuric, and -trisulphuric acids were determined, and in each case found to be equal to the conductivity of a solution of equal sulphuric acid concentration. The effects of dilute green solutions of the chloride, nitrate, sulphate, and acetate on the rate of sugar inversion were also measured in order to determine the quantity of hydrolytically dissociated acid, but owing to the unknown effect of the other ions present, accurate results were impossible. The colloïdal chromosulphuric acid of Recoura was investigated, and as the conductivity of solutions of the composition $Cr_2(SO_4)_3,xH_2SO_4$ were always equal to those of $(x - 1)H_2SO_4$ the colloïdal compound is $Cr_2H_2(SO_4)_4$. The constitution of these salts, according to the theory of Werner (Abstr., 1893, ii, 379) is considered, and the author points out that five out of the seven salts indicated by the theory, are known. (See Abstr., 1894, ii, 382; 1893, ii, 528.) L. M. J.

Uranium. By Henri Moissan (*Compt. rend.*, 1896, **122**, 1088—1093).—The author has prepared metallic uranium (1) by the action of sodium on the double sodium uranium chloride, $UCl_4,2NaCl$, in an iron tube, (2) by the electrolysis of the fused double chloride with carbon or iron electrodes, and a current of 8 to 10 volts and 50 ampères. The double chloride is obtained by the action of uranium chloride vapour on sodium chloride at a dull red heat, the uranium chloride being formed in the same tube by the action of chlorine on uranium carbide. Unlike the simple chloride, it is not very hygroscopic, and is practically non-volatile when fused.

The metal is, however, best obtained by mixing 500 parts of the oxide U_3O_8 with 40 parts of sugar carbon, and heating the mixture in a carbon tube, closed at one end, in an electric furnace, with a current of 800 ampères and 45 volts. The product contains a small quantity of carbon, which can be partially removed by heating it in a crucible brasqued with uranium oxide, and enclosed in a larger crucible brasqued with titanium to protect the uranium from the action of nitrogen.

When pure, uranium is white, takes a high polish, and can be worked with a file. It is not magnetic, and is much more volatile than iron. When finely divided, it decomposes water slowly at the ordinary temperature, and more rapidly at 100°. It burns in fluorine at the ordinary temperature, in chlorine at 180°, in bromine at 210°, and in iodine vapour at about 260°. It is also attacked by hydrogen chloride and hydrogen iodide at a red heat. When finely divided, it burns in oxygen at 170°, in sulphur vapour at about 500°, and also in selenium vapour.

One of the most remarkable properties of the metal is its great tendency to combine with nitrogen. When heated in this gas at 1000°, it becomes covered with a yellow nitride, and the powdered metal decomposes ammonia above a dull red heat, with liberation of hydrogen and formation of a black, crystalline powder. C. H. B.

Tungstates and Molybdates of the Rare Earths. By FANNY R. M. HITCHCOCK (*J. Amer. Chem. Soc.*, 1895, **17**, 483—494 and 520—534).—The author has continued the investigations of Smith and Bradbury (Abstr., 1892, 241), in the hopes of finding a good method for the separation of molybdic and tungstic acids. Pure sodium molybdate, $Na_2MoO_4 + 2H_2O$, was used in the experiments, and the corresponding tungstate; the latter, however, was not pure, but contained silica, ferric iron, and molybdates. It was found best not to prepare more than 250 c.c. of the tungstate solution, as it gradually attacks glass, and a sediment resembling silica is deposited. Experiments made with sodium tungstate and manganese sulphate showed that tungstic acid cannot be quantitatively precipitated from its salts by means of manganese salts.

Uranium acetate does not precipitate tungstic acid from its salts, but both uranyl nitrate and chloride precipitate the acid completely in the form of uranium tungstate, the precipitation also takes place in the presence of ammonium salts and alcohol. With a little care tungstic acid may be estimated volumetrically by means of uranyl nitrate solution, if potassium ferrocyanide is used as an indicator.

Sodium molybdate gives no precipitate with uranium acetate; with the nitrate, it yields a precipitate which almost completely dissolves on stirring. Uranyl chloride also gives a precipitate which redissolves on stirring; on standing, however, a pale lemon-yellow precipitate is formed, which goes into solution on boiling. On the addition of an excess of uranyl chloride to the cold molybdate solution, a similar yellow precipitate is obtained; it does not redissolve, but, when heated for an hour, grows denser, and gradually becomes crystalline. The crystals are insoluble in water, and after drying at 128° have the composition $UrO_2{:}MoO_4$. The author has found it impossible to effect a complete separation between tungstic and molybdic acid by means of uranium salts.

Sodium molybdate solution gives a precipitate with cerium salts, but the amount of *cerium molybdate* thus obtained is not theoretical, as part remains in solution, the addition of alcohol completes the precipitation, but is also liable to throw down other cerium salts which may be in solution. Sodium tungstate behaves in a very similar manner with cerium salts.

Tungstates of neodymium and of *praseodymium* were obtained by treating the sodium salts with neodymium and praseodymium chloride respectively. They form gelatinous precipitates, which are very difficult to filter and wash, as they show a strong tendency to pass through the pores of the filter paper. The *molybdates* when heated gradually become granular, and are then more easily filtered. Neodymium tungstate has a very pale rose tint before ignition, which changes to lavender colour after ignition. Praseodymium tungstate has a decided greenish-yellow tint both before and after ignition. The colours of the molybdates are similar to those of the tungstates, but deeper in tint. With the praseodymium salts, the solubility increases with a rise in temperature, but with neodymium tungstate, the solubility decreases as the temperature rises. Details as to analyses are given.

The precipitation of both molybdic and tungstic acids by neodymium chloride is practically quantitative, whereas that of molybdic acid with praseodymium chloride is not.

Sodium tungstate solution yields with lanthanum chloride, in the presence of alcohol, a precipitate, which, on drying, has a delicate blue colour. J. J. S.

Zirconium Sulphite. By FRANK P. VENABLE and CHARLES BASKERVILLE (*J. Amer. Chem. Soc.*, 1895, **17**, 448—453).—The authors have not succeeded—except in one case—in obtaining any zirconium sulphite corresponding with the acid, or normal, salts, only indefinite compounds or mixtures of the sulphite with the hydroxide have been prepared. A 2½ per cent. solution of the pure chloride, neutralised with ammonia and then saturated with sulphurous anhydride, yields a white precipitate, which, after a time, redissolves; if the clear solution thus obtained be diluted with several times its volume of water and then boiled, a heavy, white precipitate is produced. When dried and powdered, it resembles finely divided silica; the ratio of zirconium to sulphurous anhydride was 2 : 1.

Freshly prepared zirconium hydroxide was also treated with a concentrated solution of sulphurous anhydride and kept for three months, with occasional shaking, a layer of gelatinous hydroxide was deposited on the bottom of the vessel, and upon this a white, finely divided substance formed.

The white layer was analysed, and the ratio of zirconium to sulphurous anhydride was found to be 2·2 : 1.

The supernatant liquor was found to contain zirconium, and when evaporated over sulphuric acid, gave a small quantity of hard, white nodular crystals, in appearance resembling zirconium sulphate. The results of analysis proved them to be a hydrated sulphite, $Zr(SO_3)_2 + 7H_2O$.

The precipitate obtained by boiling a solution of the chloride with a solution of sodium sulphite was also analysed. The ratio of zirconium to sulphurous anhydride was found to be 4 : 1. No definite thiosulphate could be obtained by treating the chloride with sodium thiosulphate under varying conditions. J. J. S.

Action of Air and Nitric Peroxide on some Halogen Bismuth Compounds. By V. THOMAS (*Compt. rend.*, 1896, **122**, 1060—1062).—When heated gently in nitric peroxide, bismuth tribromide is converted into small, very brilliant, white lamellæ of the oxybromide BiOBr. No further loss of bromine takes place, even at a high temperature. If heated strongly in air, however, it loses bromine, and is only very imperfectly converted into the oxide

When the tribromide is heated with free exposure to air, the greater part volatilises, and the residue consists of the oxybromide. The triiodide, when heated in nitric peroxide, is first converted into the oxyiodide, and subsequently into the oxide, and the same products are formed.

Bismuth dichloride, obtained by the action of chlorine on the metal, is a black, crystalline mass, which is converted into the oxychloride by nitric peroxide in the cold, although a gentle heat accelerates the reaction. When heated in presence of air, a large part of the dichloride volatilises, but the residue has the composition and properties of the oxychloride, BiOCl. (Compare Abstr., 1895, ii, 495.)

C. H. B.

Precipitation of the Sulphides of Platinum: Colloïdal Platinic Sulphide. By Ubaldo Antony and Adolfo Lucchesi (*Gazzetta*, 1896, **26**, j, 211—218).—The whole of the metal is precipitated from a 3 per cent. aqueous solution of hydrogen platinochloride by hydrogen sulphide at 90° as pure platinic sulphide, PtS_2; for analytical purposes, the precipitate should be collected and washed in an atmosphere of hydrogen sulphide, and dried in nitrogen at 70—80°. The sulphur cannot be estimated by the authors' modification of Carius's method (Abstr., 1890, 1216), owing to the formation of barium platinochloride, which is not easily separated from the barium sulphate, nor by treatment with chlorine and bromine, for then halogen compounds of platinum volatilise, as in the case of iridium (Abstr., 1893, ii, 379).

At ordinary temperatures (15—18°) a mixed yellow and brown precipitate is slowly thrown down by hydrogen sulphide from the hydrogen platinochloride solution, and the supernatant liquid remains red; the mixed precipitate continually loses hydrogen sulphide on heating, and ultimately yields platinic sulphide at 200°. The brown and yellow precipitates are possibly platinic hydrosulphides.

The reddish mother liquor contains colloïdal platinic sulphide, which is slowly deposited even at 0°. A 0·5 per cent. aqueous solution of hydrogen platinochloride gives no precipitate at 15—18° with hydrogen sulphide, but only a red-brown coloration; no precipitate is obtained on boiling, but on adding hydrochloric acid, the solution deposits platinic sulphide, and becomes decolorised. The precipitation of platinic sulphide from the more concentrated solution at 15—18° thus seems due to the action of the liberated hydrochloric acid.

W. J. P.

Mineralogical Chemistry.

Hyacinth (Quartz) in Gypsum, near Jena. By E. Zschimmer (*Tsch. Min. Mitth.*, 1896, **15**, 457—465).—Small, red, doubly-terminated crystals of quartz occur with small crystals of dolomite in gypsum bands in the Trias beds near Jena; they enclose gypsum, and probably also anhydrite. Experiments show that silica is fairly soluble in a solution of magnesium hydrogen carbonate (10 litres containing 1·3342 gram SiO_2, and 15·191 grams $MgCO_3$), and that, when calcium sulphate is added to this solution, about 35 per cent. of the silica is deposited. The origin of the quartz crystals in the gypsum is therefore attributed to the action of such a solution on beds of anhydrite. L. J. S.

A new Cobalt Mineral. By PABLO MARTENS (*Actes Soc. Sci., Chili*, 1895, **5**, 87—88).—The mineral is black and amorphous; streak, black; fracture, conchoidal; sp. gr., 3·39; H = 3·5. With hydrochloric acid it gives off chlorine; over sulphuric acid some water is lost. Analysis gave

Co.	Cu.	SiO_2.	Fe_2O_3.	H_2O (hygroscopic).	H_2O (combined).	O [diff.].
46·76	12·65	1·76	0·29	4·92	14·08	[19·54]

This agrees with $CuO,2CoO,Co_2O_3 + 4H_2O$. The exact locality is not known, but is probably in the north of Chili. The mineral is named *Schulzenite*, after J. Schulze, in whose collection it was found. L. J. S.

Formation of Tin Veins. By FERDINAND GAUTIER (*Actes Soc. Sci., Chili*, 1895, **5**, 82—84).—From the non-occurrence of minerals containing fluorine in the cassiterite veins of some districts of Bolivia, the author supposes the tin dioxide to have been formed by the interaction of water vapour and tin chloride. The cassiterite of another Bolivian locality shows impressions of quartz crystals; this seems to imply that there has here been interaction between water vapour and tin fluoride, the quartz being acted on by the hydrogen fluoride formed, and removed as silicon fluoride; minerals containing fluorine are, however, in this case also absent. L. J. S.

Origin of Nitrates in Griqualand West. By R. MARLOTH (*Trans. S. African Phil. Soc.*, 1896, **8**, 113—118).—Under cliffs and in caves in the Asbestos Mountains and the Doornbergen of S. Africa, there are deposits of nitrates, which have their origin in the nitrification (by microbes) of animal refuse, principally the fæces of rock rabbits; the potassium has partly been supplied by the animal matter, and partly derived from the associated rocks. The deposits contain calcium sulphate, indicating that the potassium nitrate has been formed by the interaction of calcium nitrate and potassium sulphate. L. J. S.

Aluminium and Potassium Phosphates. By ADOLPHE CARNOT (*Ann. des Mines*, 1895, [9], **8**, 311—320).—An analysis of a specimen of "minervite," from Dépt. Hérault, very similar in appearance to the aluminium and potassium phosphate from the cavern of Tour-Combes, Oran (this vol., ii, 34), gave the following results, which are almost the same as those obtained for the mineral from the latter locality, but which differ, especially in the presence of potassium, from those shown in Gautier's analysis of the minervite of Hérault (Abstr., 1893, ii, 419, 577). The author, therefore, considers minervite, not as a hydrated phosphate of aluminium alone, but of aluminium and potassium, in which part of the aluminium is replaced by iron, and part of the potassium by ammonium, calcium, and magnesium.

P_2O_5.	Al_2O_3.	Fe_2O_3.	K_2O.	CaO.	MgO.	NH_4.	H_2O (at 180°).
37·28	18·59	0·83	8·28	1·40	0·33	0·52	23·70

Loss from 180° to redness.	Sand, &c.	F,Cl,SO_3.	Total.
4·50	4·35	traces	99·78

Formula, $P_2O_5 + 0·70(Al,Fe)_2O_3 + 0·25(K_2,Am_2,Ca,Mg)_2O_2 + 5·40H_2O$. This is nearly the composition of a mixture of Al_2O_3,P_2O_5, with mono- and di-basic phosphates of the other bases.

L. J. S.

Thaumasite. By Félix Pisani (*Bull. Soc. fran. Min.*, 1896, **19**, 85—87).—The thaumasite from Paterson, New Jersey, recently described by Penfield and Pratt (this vol., ii, 367), has been analysed, the more crystalline portion being used.

SiO_2.	CO_2.	SO_3.	CaO.	H_2O.	Al_2O_3,Fe_2O_3.	Total.
8·95	8·25	12·60	27·30	43·70	0·30	101·10

This gives the formula $2CaO,2(SiO_2,CO_2) + CaO,SO_3 + 16H_2O$, there being here slightly less silica, and slightly more carbonic anhydride and water than in the Swedish mineral. Dilute hydrochloric acid easily decomposes it, and water dissolves out traces of calcium sulphate. There is practically no loss at 100°. Under the microscope, the mineral appears homogeneous, and to be monosymmetric; it is to be considered as a definite species. L. J. S.

Pickeringite from New South Wales. By George W. Card (*Records Geol. Survey, N.S.W.*, 1896, **5**, 6—14).—Pickeringite, as aggregates of delicate silky fibres, gave analysis I (by J. C. H. Mingaye) for material from Capertee, and II (by White) for material from the Shoalhaven district.

	Al_2O_3.	MgO.	K_2O.	Na_2O.	SO_3.	Insol.	Water [diff.].
I.	7·14	9·03	0·32	0·53	35·68	1·51	[45·79]
II.	10·91	4·68	1·06	trace	38·14	1·74	[42·37]

In II, the percentage of magnesia is normal, but in I it is unusually high (compare this vol., ii, 251). It seems likely that many of the magnesium alums, which have been described under various names, are not homogeneous.

Various minerals and rocks from New South Wales are shortly described in the paper. L. J. S.

A Blue Mineral, supposed to be Ultramarine, from New Mexico. By R. L. Packard (*Proc. U.S. National Museum*, 1895, **17**, 19—20).—A blue, earthy mineral, which, when first found, was supposed to be ultramarine, occurs as irregular veins in the limestone carrying the silver ore at Chloride Flat, near Silver City, New Mexico. The material, after being purified as far as possible by hydrochloric acid and sodium carbonate solution, gave the following results on analysis.

Ignition.	SiO_2.	MgO.	FeO.	Al_2O_3.	K_2O.	Na_2O.	Total.
6·47	62·43	28·53	0·99	0·25	0·14	0·16	98·97

Chemically it is, therefore, like talc, but it differs from the latter in physical properties. L. J. S.

Synthesis of Topaz. By ALFRED REICH (*Monatsh.*, 1896, **17**, 149—171).—The contradictory results obtained by Daubrée and St. Claire Deville have led the author to again attempt the preparation of fluorine compounds by the action of silicon fluoride on aluminium silicate.

Amorphous aluminium silicate, having approximately the composition Al_2SiO_5, was obtained by adding aluminium sulphate solution to a solution of sodium silicate and caustic soda, the precipitate being subsequently washed by decantation and dialysis; this, after calcination, was heated to bright redness in a current of carefully dried silicon fluoride. The silicate increased in weight by 42·4—43·1 per cent., and the product consisted of indefinite, doubly refracting, seemingly rhombic crystals, which gave on analysis, in parts per cent., SiO_2, 42·24—42·46; Al_2O_3, 44·54—45·17, and F_2, 22·06.

A crystalline aluminium silicate, made by a modification of Frémy and Feil's process (Abstr., 1878, 203), consisted of a mixture of corundum with andalusite or sillimanite; the various preparations made contained in parts per cent., SiO_2, 5—24; and Al_2O_3, 75—95, but all, when heated in silicon fluoride, increased by 33—38 per cent. in weight, yielding products, which gave on analysis, SiO_2, 31·70—33·04; Al_2O_3, 55·01—57·03; and F_2, 18·17—20·09, or, approximately, $Al_2SiF_2O_4$. The numbers are so nearly identical with those given by topaz that the substance must be considered as artificial topaz. The few crystallographic measurements possible with the artificial crystals also agree very closely with those of the mineral. On strongly heating the artificial crystals, a product of the percentage composition SiO_2, 29·56, and Al_2O_3, 67·95, results; these numbers are practically identical with those given by the product of heating natural topaz. Silicon fluoride cannot be the only substance driven off by heat, aluminium fluoride or fluorine must also be volatilised.

The author has not succeeded in obtaining concordant results with Jannasch's method (Abstr., 1895, ii, 460) of analysing silicates containing fluorine, and recommends the following process. A mixture of 4—6 parts of sodium hydroxide with one of the silicate is fused in a silver crucible for 10—15 minutes; the product is then dissolved in water and precipitated by carbonic anhydride. The liquid is evaporated to a small bulk with ammonium carbonate, and three or four successive quantities of ammonium carbonate added and evaporated off. Warm water is then added, and the precipitate filtered on a platinum funnel and washed with ammonium carbonate solution; the precipitate contains all the alumina and silica, and a little silver, which are separated, and the former two constituents estimated in the usual way. The filtrate is evaporated to drive off ammonium carbonate, acidified with acetic acid, rendered alkaline with lime water, evaporated to dryness, the residue taken up with water, and the solution filtered. The precipitate is lightly calcined and treated with dilute acetic acid; the calcium fluoride is weighed as such, then treated with sulphuric acid, and weighed as calcium sulphate as a control.

W. J. P.

[Phillipsite from Wingendorf, Prussian Silesia.] By P. KRUSCH (*Jahrb. k. Preuss. Geol. Landesanst. and Bergakad.*, 1895, **15**, (1894), 312—314).—In a description (p. 279—324) of the basalts occurring between Neisse and the River Queiss, Prussian Silesia, an analysis (by Klüss) is given of phillipsite from the basalt of Wingendorf, near Lauban. The rock here is especially rich in zeolites; phillipsite occurs as water-clear, twinned crystals.

Al_2O_3.	CaO.	K_2O.	Na_2O.	H_2O (at 100°).	H_2O (at 200°).	H_2O (on ignition).	SiO_2 [diff.].
19·92	4·74	6·34	1·72	3·86	6·44	6·37	50·61

L. J. S.

Felspars of Igneous Rocks. By FERDINAND FOUQUÉ (*Zeits. Kryst. Min.*, 1896, **26**, 300—316; from *Bull. Soc. fran. Min.*, 1894, **17**, 283—611).—Optical and chemical determinations, both made on the same material, are given of numerous felspars from various rocks; the former include the extinctions in sections perpendicular to *a* and *c*, and on *c*(001) and *b*(010), the optic axial angle, the indices of refraction, &c. The following analyses of homogeneous material, separated by means of methylenic iodide, are given: I, anorthite from Etna; II—IV, labradorite-bytownite from the Azores; V, do. from Besseyre, Haute-Loire; VI—VIII, labradorite from the Azores; IX, andesine from Chenavary, Ardèche; X—XI, do. from Arcuentu, Sardinia; XII, oligoclase-andesine from Alagnon, Haute-Loire;

	SiO_2.	Al_2O_3.	CaO.	Na_2O.	K_2O.	MgO.	Fe_2O_3.	Total.	Sp. gr.
I...	44·1	37·8	18·6	0·9	—	—	trace	100·4	2·748
II...	53·4	29·4	12·5	4·8	0·2	—	—	100·3	2·710
III...	54·2	30·3	11·8	3·9	0·2	—	—	100·4	2·705
IV...	53·3	30·1	11·4	5·1	0·1	0·1	trace	100·1	2·705
V...	54·5	29·8	11·4	4·5	0·3	—	—	100·5	2·698
VI...	55·4	29·4	9·7	5·7	—	0·2	0·5	100·9	2·695
VII...	55·9	29·3	9·7	5·0	0·3	—	—	100·2	2·698
VIII...	54·9	29·3	10·25	5·35	0·07	0·06	0·6	100·53	2·696
IX...	58·65	26·50	8·41	6·09	0·37	—	—	100·02	2·662– 2·685
X...	62·65	24·19	6·28	6·48	1·24	—	—	100·74	—
XI...	63·80	23·43	6·26	5·58	1·44	—	—	100·51	—
XII...	62·4	22·8	7·00	8·4	0·5	—	—	101·1	2·642
XIII...	64·32	23·05	3·90	8·50	0·54	—	—	100·31	2·642
XIV...	68·2	19·0	—	13·5	—	—	—	100·7	2·624
XV...	67·9	19·4	2·4	10·9	0·3	—	—	100·9	2·592
XVI...	67·7	19·7	0·7	11·1	1·7	—	—	100·9	2·597
XVII...	67·8	20·0	0·6	10·5	1·3	—	—	100·2	2·608
XVIII...	67·67	19·45	0·47	9·21	3·95	—	—	100·75	2·572
XIX...	68·3	19·5	trace	7·1	5·7	—	—	100·6	2·585
XX...	66·9	19·8	1·3	7·6	4·5	—	—	100·1	2·567
XXI...	68·0	20·1	0·6	10·1	1·2	—	—	100·0	—

XIII, oligoclase from Mexico?; XIV, albite from Modane, Savoy; XV, albite from Albepeyre, Haute-Loire; XVI—XVIII, anorthoclase from the Azores; XIX, do. from Sardinia; XX, do. from Mont Dore; XXI, do. from Liberté, Haute-Loire.

The author is led to the conclusion that the rock-forming anorthic felspars are represented by the following types of definite composition, between which there are no intermediate members, but which may intergrow with one another; this is opposed to Tschermak's theory of a mixed series. Several of these types usually occur together in the same rock, the later ones being the more acid.

	Sp. gr.	SiO_2 per cent.	2V.	Optical sign.	Extinction on		β_{Na}
					c(001).	b(010).	
Anorthite............	2·745	44	77° 30′	—	−36° 30′	−41° 30′	1·582
Bytownite............	2·725	—	—	—	—	—	—
Labradorite-bytownite .	2·705	54	77	+	−11	−25	1·563
Labradorite..........	2·696	55	77	+	− 5 30	−20	1·558
Andesine.............	2·675	58	88	+	− 2 30	−10	1·553
Andesine-oligoclase....	2·654	62	86	—	− 2	− 4	—
Oligoclase............	2·645	64	88	—	+ 2	+ 8	1·542
Oligoclase-albite......	2·640	65	88 30	+	+ 2 30	+10 30	—
Albite................	2·610	68	77	+	+ 4	+19 30	1·534
Anorthoclase..........	2·580	68	45	—	+ 2	+ 9	1·528
Microcline-anorthoclase	2·570	—	60	—	—	—	—
Microcline..........	2·560	65·5	88	—	+15 30	+ 5 30	1·526

The following analyses are also given: I, yellow-brown hornblende from biotite-hornblende-andesite from Lioran; II, biotite from biotite-obsidian from the Plomb du Cantal.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MgO.	CaO.	Na_2O.	K_2O.	Total.
I.	41·3	15·6	11·5	3·2	13·5	13·1	1·4	0·3	99·9
II.	43·4	20·4	9·1	—	17·1	1·7	0·2	8·6	100·5

L. J. S.

Mica-syenite from Rothschönberg, Saxony. By J. M. C. HENDERSON (*Zeits. deutsch. geol. Ges.*, 1895, **47**, 534—547).—A dyke rock containing orthoclase, plagioclase, biotite, muscovite, quartz, magnetite, apatite, calcite, and pyrites from Rothschönberg, near Deutschenbora, in the Kingdom of Saxony, gave analysis I; the structure is panidiomorphic-granular, so that the rock is called a mica-syenite rather than a lamprophyre. Analysis II is of the felspar of sp. gr. 2·62—2·63; although apparently fresh, it is kaolinised, as is seen under the microscope and by the water in the analysis.

	SiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	CO_2.	S.	Total.
I.	57·63	16·47	5·37	5·25	4·44	3·12	5·15	0·45	2·14	0·95	100·97
II.	66·67	16·81	0·97	2·06	0·54	4·82	5·89	1·80	0·25	—	99·81

L. J. S.

[Analyses of Sericite, Augite, and Waters from Bohemia.] By J. E. Hibsch (*Tsch. Min. Mitth.*, 1895, **15**, 201—290).—In a paper explanatory of the geological map of the Bohemian Mittelgebirge are given several analyses of rocks, together with the following of minerals and waters. I is the mean of two analyses of sericite from a sericite-albite-gneiss, near Tetschen. II (by R. Pfohl) is of augite from a leucite-tephrite containing nepheline from Falkenberg; sp. gr., 3·37.

	SiO_2.	TiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	47·85	—	35·86	3·12	—	0·55	0·25	8·56	0·54	0·51	101·24
II.	45·67	0·62	9·04	7·46	2·00	21·78	12·09	0·56	1·25	0·31	100·78

Water from a spring near Liebwerd, east of Tetschen, gave III in 100,000 parts; from a spring near Gomplitz, IV; both analyses by F. Ullik.

	CaO.	MgO.	K_2O.	Na_2O.	Al_2O_3,Fe_2O_3.	Cl.	SO_3.	SiO_2.	NH_3.	N_2O_5.	Reduced $KMnO_4$.	CO_2.
III.	5·05	1·28	0·37	2·03	0·18	0·64	0·82	4·50	trace	trace	0·12	6·35
IV.	14·67	2·33	0·28	0·93	0·26	0·71	0·21	1·65	trace	trace	0·27	19·9

L. J. S.

Serpentine after Amphibolite. By John B. Jaquet (*Records Geol. Survey, N.S.W.*, 1896, **5**, 18—25).—A description is given of the intrusive and metamorphic rocks of Berthong, Co. Bland, N.S.W.; the ultrabasic rocks include an amphibolite, which consists of hornblende, with a little magnetite and, rarely, chromite; this has been altered in places to serpentine, as is seen by the intimate association of the two rocks, and by the microscopical examination. The serpentine, which contains magnetite and chromite, gave analysis I, and the adjacent amphibolite, analysis II (by J. C. H. Mingaye). The alteration has been accompanied by a removal of alumina and silica.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	Cr_2O_3.	(Co,Ni)O.	CaO.	MgO.	Na_2O.	K_2O.	H_2O (at 110°).	H_2O (combined).	Total.	Sp. gr.
I.	40·80	2·54	6·20	0·48	trace	0·29	0·25	—	32·82	0·27	—	2·87	10·11	99·63	2·52
II.	49·30	10·42	2·20	3·83	—	trace	trace	11·82	19·36	1·14	0·50	0·26	0·79	99·62	3·00

L. J. S.

A Mineral Spring at Bungonia. By J. Milne Curran (*Jour. and Proc. Roy. Soc., N.S.W.*, 1894, **28**, 54—59).—Analysis of the water of a spring at Bungonia, New South Wales, gave the following results in grains per gallon: SiO_2, 1·47; FeO, 0·19; CaO, 35·00;

MgO, 5·18; Na_2O, 5·53; K_2O, 4·27; Cl, 5·88; SO_3, 1·16; CO_2 (combined), 34·86; H_2O (combined), 10·75 = total solids, 104·29 (less oxygen for Cl = 103·04).

Carbonic anhydride is given off by the water with deposition of a tufa, either porous or compact and crystalline, which gave on analysis,

Insol. in HCl.					
Organic matter.	SiO_2.	Fe_2O_3, Al_2O_3.	$CaCO_3$.	$MgCO_3$.	Na_2CO_3, K_2CO_3.
7·9	3·6	0·9	79·4	2·3	1·0

H_2O (combined).	Total.	Sp. gr.
4·9	100·0	2·58

L. J. S.

The new hot Springs of Ædipsos and Gialtra. By ANASTASIUS K. DAMBERGIS (*Tsch. Min. Mitth.*, 1896, **15**, 385—393).—During the Locris (Greece) earthquakes of April, 1894, more than one hundred new hot springs were started at Ædipsos and Gialtra, whilst the old ones were affected as regards quantity of water and temperature, there being an increase in most cases. The new springs are of the same nature as the old ones, the temperature varying from 32° to 82°; determinations of the total solids, chlorine, and carbonic anhydride (in grams per litre) are given for several springs, the extremes of which are given below, and compared with the extremes obtained for the old springs in 1889 (Abstr., 1892, i, 418) and 1894. The vapour of many of the new springs smells of hydrogen sulphide, as does that of the old springs; only in one case was there a determinable amount of hydrogen sulphide, however, namely, 21·7 c.c. in a litre of water.

	Total solids.	Chlorine.	Carbonic anhydride.
New springs of Ædipsos ...	19·188—37·327	12·699—21·300	0·601—0·698
,, ,, Gialtra	37·505—39·149	18·083—19·380	0·656—0·692
Old springs of Ædipsos (1889)	22·958—33·355	13·119—19·230	0·561—0·673
,, ,, ,, (May, 1894)	29·580—39·707	15·655—19·241	—

L. J. S.

Physiological Chemistry.

Influence of Fat and Starch on Metabolism. By A. WICKE and HUGO WEISKE (*Zeit. physiol. Chem.*, 1896, **22**, 137—152).—In this second series of experiments, the same two sheep were employed as on a previous occasion (Abstr., 1895, ii, 516).

The daily diet was 800 grams of air-dried hay and 200 grams of linseed; this was continued for eight days, the urine and fæces being examined every day. During a second period, in addition, 146·4 grams of starch, and during a third period an equivalent quantity (in heat value, 60 grams) of olive oil was given.

In both cases the amount of nitrogen excreted was lessened, but this proteïd sparing action was much more marked in the starch than in the fat periods. W. D. H.

Nutritive value of Gland-peptone. By Alexander Ellinger (*Zeit. Biol.*, 1896, **33**, 190—218).—Most previous observers have stated that various commercial preparations of "peptone" are of equal nutritive value to that of native proteïd. Voit, however (*Hermann's Handbuch*, **6**, 121), did not find this to be the case in dogs with the form of peptone he used. The different kinds of so-called peptone used account in some degree for this difference in result. The present research was also carried out on dogs. The peptone chiefly investigated was gland-peptone, an antipeptone of low molecular weight, formed by the auto-digestion of the pancreas. This, in contrast to albumin and Witte's peptone (chiefly albumoses), does not maintain nitrogenous equilibrium; the animal loses weight, and gets ill. It is suggested that the intestinal epithelium is not able to reconvert such large doses of peptone of low molecular weight into albumin, but that some is absorbed as such, and produces harmful results. W. D. H.

Absorption of Proteïds in the Small Intestine. By Georg Friedländer (*Zeit. Biol.*, 1896, **33**, 264—287).—Physiologists have lately arrived at the conclusion that mere physical reasons will not explain absorption in the alimentary canal; and in special connection with proteïds, that their change into peptone before absorption is not absolutely necessary. Proteïds, when in excess, are absorbed unchanged, and appear in the urine. They usually undergo some change, either before or during their passage through the mucous membrane, so that, even if they are not peptonised, they cannot be recognised in their original form afterwards. In the present research, known quantities of proteïd in solution were injected into isolated loops of intestine a considerable distance from the pylorus, and their contents were subsequently examined, allowance being made for any proteïd matter from the intestinal wall. In the following table the mean percentage of proteïd absorbed is given for a number of different proteïds used in the experiments.

Caseïn	0
Acid-myosin	0
Acid-albumin	0
Egg-albumin and serum albumin	21
Alkali-albumin	69
Albumoses	72
Peptone	91

W. D. H.

Molybdic acid as a Microscopic Reagent. By L. Heine (*Zeit. physiol. Chem.*, 1896, **22**, 132—136).—Lilienfeld and Monti's (Abstr., 1893, ii, 135) method for microchemically localising phosphorus is not regarded as trustworthy. The reduction, either by pyrogallol or by stannous chloride, as some recommend, occurs in structures and substances which are free from phosphorus. W. D. H.

Thymin from the Spermatozoa of the Sturgeon. By Albrecht C. L. M. L. Kossel (*Zeit. physiol. Chem.*, 1896, **22**, 188—190).—Thymin, previously prepared from the nuclei of the thymus, is also obtainable as a decomposition product of the nucleic acid of the spermatozoa of the sturgeon. W. D. H.

Hæmatoporphyrinuria. By Barend J. Stokvis (*J. Pathol. and Bacteriol.*, 1896, **4**, 155).—The author previously considered that the hæmatoporphyrin in normal urine and in that of patients taking sulphonal, was due to the presence of blood in the alimentary canal (*Zeit. f. Med.*, **27**, 1). Garrod and Hopkins (this vol., ii, 264) doubted this explanation, and it is now withdrawn, because the urine of rabbits contains the material when they are feeding on blood-free food, and living under conditions which exclude hæmorrhages. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Proteïds and Carbohydrates of Green Leaves as Products of Assimilation. By W. Saposchnikoff (*Bied. Centr.*, 1896, **25**, 106—108; from *Bot. Centr.*, 1895, **62**, 246; compare Abstr., 1891, 763; *Bied. Centr.*, 1893, 70, and 1894, 775).—The results of experiments, in which cut leaves of *Vitis vinifera* and *V. labrusca* were kept in a nutritive solution and in distilled water respectively, showed that with plenty of nitrate and a moderate amount of light, there is an increased production of proteïds with lessened formation of carbohydrates, or the production of carbohydrates may be quite suppressed. Asparagine cannot serve as a source of nitrogen for producing proteïds in cut leaves.

In an atmosphere rich in carbonic anhydride, the production of carbohydrates is increased, even when light is unfavourable, but there is no increased production of proteïds.

When entire plants are kept in the dark, there is not only a migration of carbohydrates, but also, although to a less extent, of proteïds from the leaves.

The maximum accumulation of different substances in cut leaves, of which the stalks dipped in water or nutritive solutions, was as follows: Carbohydrates, in the two varieties of *Vitis* = 23—29 per cent.; sugar = 5·2 per cent.; starch = 8 per cent. of the dry matter. In leaves of *Rubus cæsius* and *fruticosus* the maximum for sugar was found to be between 6 and 7 per cent. N. H. J. M.

The Position of Arsenic in Plant Production. By JULIUS STOKLASA (*Bied. Centr.*, 1896, **25**, 353; from *Chem. Rep.*, 1896, 16).—A number of plants, 35 days' old, were treated with nutritive solutions containing (1) 0·019 gram of arsenious acid, (2) 0·023 gram and (3) 0·23 gram of arsenic acid. In solution (2) there was no poisoning; in solution (1) the plants were killed in 46 to 90 hours; in solution (3) in 24—42 days.

Further experiments with oats showed that arsenic acid cannot take the place of phosphoric acid, but that, in absence of phosphoric acid, it will induce increased production of organic substance up to the flowering period. N. H. J. M.

The Tannin of Fungi. By OTTO NAUMANN (*Bied. Centr.*, 1896, **25**, 353; from *Bot. Centr.*, 1896, **65**, 254, and *Inaug. Diss.*, *Erlangen*).—Fungi cannot produce tannin, but may take it up and utilise it as food when decomposed. Certain fungi do not absorb tannin, and are injured in presence of excessive amounts. *Polyporeæ* contained 0·034 to 0·400 per cent. of tannin; *Agaricaceæ*, 0·041 to 0·060 per cent. Parasites usually contained more tannin (0·180—0·400 per cent.). The relatively small amounts of tannin in fungi as compared with various plants confirms Hartig's view, that in fungi the tannin is chemically decomposed. N. H. J. M.

Nutrition and Formation of Substance in Sugar Beet in the Second Year of Growth. By FRIEDRICH STROHMER, H. BRIEM, and A. STIFT (*Bied. Centr.*, 1896, **25**, 170—172; compare *ibid.*, 1893, **22**, 473).—The experiments now recorded were made with entire roots instead of with half roots. The mineral and organic matters of a root are not sufficient for the production of leaves and stems, &c., so that application of nutritive matter is necessary, if it is not already present in the soil in an assimilable state. In the second year of growth, the newly produced substance of the whole plant shows a gradual decrease of non-nitrogenous extract, mainly due to a gradual decrease of this substance in the dry matter of the root. The dry matter of the developing plant, however, shows a gradual increase of crude fibre, nitrogen, and ash constituents. Mineral matter is taken up by the root in the first period of growth. The object of the nitrogen-free reserve substance seems chiefly to provide for the heat necessary for growth. Nitrogen is of most importance for the production and character of seed. Proteïds, as well as the nitrogen-free extract substances, seem to have the same physiological function in the life of plants as in animals. N. H. J. M.

The Nutritive Substances of Beetroot. By W. SCHNEIDEWIND and H. C. MÜLLER (*Bied. Centr.*, 1896, **25**, 315—326; from *J. Landw.*, 1896, **44**).—By cultivation and selection of beetroot for sugar, the amount of ash in the roots was often reduced to little more than half the average amounts given by Wolff, whilst the amount of ash in the leaves was not influenced. The amounts of ash and of nitrogen are in inverse proportion to the amount of sugar, the composition of the ash also being of importance. Potash manures and sodium nitrate increase the percentage amounts of potassium and sodium respectively in roots and leaves, and also the total amounts. Kainite increases the taking up of potash but not of soda or magnesia. Manuring with lime gives rise to increased amounts of lime in the plants, but the lime is diminished by applications of potash and soda.

Manuring with kainite can increase assimilation of phosphoric acid, but without benefit as regards sugar production. A further effect of kainite is to increase assimilation of chlorine, which is mainly stored up in the leaves; this seems to be beneficial, owing to the plant acids being diminished as the chlorine increases.

Late application of nitrogen is not recommended; luxuriance of leaves should be obtained as early as possible. Sodium nitrate acts, however, more quickly than potassium nitrate (owing to its being more readily soluble and diffusible), and may be applied as an early top dressing with greater effect than before sowing.

The mutual influence of single nutritive substances has an important *rôle* in plant life, and should be investigated under different conditions of soil, &c.

N. H. J. M.

Amount of Acid in Rhubarb Stems and in Rhubarb Wine. By R. OTTO (*Bied. Centr.*, 1896, **25**, 128—129; from *Landw. Jahrb.*, 1895, **24**, 273).—The microchemical examination of rhubarb stems showed the presence of calcium oxalate, in some varieties in large quantities. The following amounts of free oxalic acid were found in different varieties of rhubarb stems at the flowering period (17 and 18 May):—Prince of Wales, 0·1913; Queen Victoria, 0·1943; *Rheum nepalense*, 0·2153; *R. paragon*, 0·2230; and *R. nutans*, 0·3161 per cent. On the 4th June, the following percentages were found:—*R. crispum*, 0·2080; *R. leucorhizum*, 0·2220; *R. palmatum*, 0·2580; *R. nepalense*, 0·2710.

Rhubarb wine, as prepared from the stems, had the following composition (grams per 100 c.c.).

Extract.	Alcohol.	Acid.	Glycerol.	Oxalic acid.	Ash.	Sp. gr. at 15°.
2·412	3·94	0·748	0·547	0·0670	0·397	1·0005

The oxalic acid is very readily removed by adding precipitated calcium carbonate (in this case 0·72 gram per litre).

N. H. J. M.

Identification and Isolation of Acids contained in Plants. By LÉON LINDET (*Compt. rend.*, 1896, **122**, 1135—1137).—Methylic alcohol of 95° G.L. dissolves only 0·3 per cent. of quinine hydrogen citrate and 3·3 per cent. of the normal salt, but it dissolves 8·2 per cent. of quinine hydrogen malate and 8·0 per cent. of the normal salt. It also dissolves 9·2 per cent. of quinine hydrogen oxalate, and 8·2 per cent. of the normal oxalate.

A methylic alcohol solution of cinchonine, precipitates malic acid in the same circumstances as quinine precipitates citric acid, the solubility of cinchonine hydrogen malate being only 2·5 per cent. All the other salts of cinchonine with vegetable acids are much more soluble. Citric acid and other acids, however, tend to prevent the precipitation of malic acid by cinchonine.

The vegetable juice is evaporated to dryness in a vacuum, and the residue treated with methylic alcohol. Tartaric acid and potassium hydrogen-tartrate, if present, must be removed. The methylic alcohol solution of acids is diluted until it contains about 2·5 per cent. of acid, and solid quinine is added in successive small portions, with continual agitation, until the whole liquid changes to a mass of crystals. The proportion of quinine should not exceed 160—170 parts for every 100 parts of citric acid supposed to be present. After 24 hours the liquid is filtered, and the filtrate is treated in the same way. After removal of the quinine hydrogen citrate, if citric acid is present, cinchonine is added in the same way, in order to precipitate the malic acid. The acids are afterwards readily liberated from the quinine or cinchonine salt. C. H. B.

Presence of a Glucoside of Methylic Salicylate in Monotropa Hypopithys, and a Ferment which hydrolyses it. By EMILE E. BOURQUELOT (*Compt. rend.*, 1896, **122**, 1002—1004).—When the stalks of *Monotropa hypopithys* are added to boiling alcohol of 95°, the liquid dissolves a glucoside, which can be isolated in the usual way, and which is probably identical with gaultherin. It is precipitated by ether from its alcoholic solution; its aqueous solution is lævogyrate. If the aqueous solution is boiled with dilute sulphuric acid, it yields methylic salicylate. *Spiræa Ulmaria* and *S. Filipendula*, *Gaultheria procumbens*, *Polygala Senega* and *Betula lenta* contain a ferment which liberates methylic salicylate from the glucoside; it remains in the insoluble matter when parts of these plants are completely exhausted with alcohol of 90°. Azalea petals and the root of *Spiræa salicifolia* contain the same ferment, but it is not present in the bark of *Betula alba*. That it is a specific ferment is shown by the fact that it does not affect other glucosides, whilst the glucoside yielding methylic salicylate is not affected by other ferments. It follows that plants which yield methylic salicylate, contain this substance in the form of a glucoside, from which it is liberated by the action of a specific ferment present in the same organs of the plant.

Schneegans has given the name *betulase* to the ferment obtained by Procter from the bark of *Betula lenta*, but the author regards as preferable the name *gaultherase*, which recalls the substance on which the ferment acts (compare Abstr., 1895, ii, 177). C. H. B.

Nitrogen Compounds of Malt and Beer Worts. By E. EHRICH (*Bied. Centr.*, 1896, **25**, 333—337; from *Bierbrauer*, 1895, 145, 161, and 177; compare Abstr., 1895, ii, 181).—Experiments on the separation of the nitrogenous compounds, showed that lead acetate precipitates more than copper hydroxide, and that phosphotungstic acid precipitates more than lead acetate and tannin together. Tannin precipitates more so-called peptone nitrogen from the filtrate from the albumin precipitate than from the original solutions containing albumin. The method adopted was to precipitate first with lead acetate, and to treat the filtrate (after removal of the lead) with tannin.

In the germination of barley, the proteïds become peptonised, the more the nitrogenous compounds are dissolved the further the development proceeds (within the ordinary limits of malt production). The most favourable temperature for peptonisation is 50°. Of nitrogen compounds, proteïds have the least nutritive value for yeast.

N. H. J. M.

Composition of the Flower Dust of Sugar Beet. By A. Stift (*Bied. Centr.*, 1896, **25**, 180—182; from *Oest.-Ung. Zeit. f. Zuckerind. und Landw.*, 1895, **24**, 783—788).—The substance, freed as well as possible from foreign matter, still contained 7·83 per cent. of sand. The following percentage results are calculated on the substance free from sand.

Water.	Proteïn.	N. as NH_3.	Other nitrogenous matter.	Fat.	Starch and dextrin.	Pentosans.	Other N.-free substances.
9·78	15·25	0·41	2·50	3·18	0·80	11·06	23·70

Crude fibre.	Ash.	K_2O (in ash).	P_2O_5 (in ash).
25·45	8·28	5·80	6·65

The nitrogen as ammonia is probably chiefly in the form of trimethylamine. The substance contains free oxalic acid. Besides cane sugar, the substance contains a second sugar, which reduces Fehling's solution.

N. H. J. M.

Nitrates in Potable Waters. By J. J. Théophile Schloesing (*Compt. rend.*, 1896, **122**, 1030—1038; compare Abstr., 1895, ii, 286). —The author has estimated at various times in the course of 14 months the quantities of calcium and nitric acid in the waters of the Vanne, the Dhuis, and the Avre. In the case of the Vanne and the Dhuis, the variations in the proportions of calcium and nitric acid respectively are in no constant relation to one another, and are not influenced in any definite manner by the volume of water passing down the streams. It would seem, therefore, that the variations are due to geological, rather than to climatic causes. In the case of the Avre, on the other hand, the quantity of calcium and nitric acid present decreases generally when the volume of water in the stream increases, and *vice versâ*. Moreover, the proportions of calcium and nitric acid vary, as a rule, in the same direction, and it follows that the water of the Avre is a mixture of true spring water with either surface water or water that has percolated rapidly through soil and rocks in which no formation of nitrates is taking place.

C. H. B.

Analytical Chemistry.

Estimation of Water in Superphosphates. By Leonard de Koningh (*Ned. Tydschr. Pharm.*, *&c.*, 1896, 190—191).—In order to prevent volatilisation of free acid during ignition, in estimating the total amount of water in superphosphates, 5 grams of the sample is mixed with about 1 gram of freshly ignited magnesia, and the whole is then exposed to a dull red heat. If the sample contains ammonium sulphate, it must be remembered that although the sulphuric acid is completely retained by the magnesia, the ammonia volatilises, and must be allowed for.

This method cannot, of course, be employed if organic substances and nitrates are present. L. DE K.

Use of Aldehydes containing Ozone for the Detection of extremely small quantities of Iodine in the presence of Chlorine and Bromine. By EUGEN LUDWIG (*Ber.*, 1896, **29**, 1454—1456).—Aldehydes that have been distilled in a current of air liberate iodine from a solution of an iodide, but have no effect on bromides or chlorides. They do not possess this property after distillation in a current of carbonic anhydride. A very sensitive reagent for iodides can be obtained by leaving 1 c.c. of acetaldehyde for one hour in a 2-litre flask; or by heating benzaldehyde to boiling in a test tube, and making 10 drops of it into an emulsion with 10 c.c. of water. A very small quantity of the reagent is added to the solution of the iodide, and the solution is then shaken with the smallest possible quantity of colourless carbon bisulphide; with 1 part of iodine in 50,000 originally present, a perceptible pink tinge is obtained.

If a solution of potassium iodide is boiled with paraldehyde while a current of air is passed through the mixture, all the iodine is driven over, and potassium acetate remains in the solution.

Since aldehydes can hold ozone in solution for a comparatively long time without becoming oxidised, the author thinks they must form peroxides with it, possibly analogous to the compounds they form with sodium hydrogen sulphite. C. F. B.

Estimation of Sulphur in Inorganic Sulphides. By PAUL JANNASCH and H. LEHNERT (*Zeit. anorg. Chem.*, 1896, **12**, 129—131; compare Abstr., 1894, ii, 330).—About 0·5—0·75 gram of natural cinnabar is heated in a current of dry oxygen in the apparatus already described by the author, and the evolved sulphurous anhydride collected in a solution of hydrogen peroxide. When the combustion is completed, and the mercury distilled, the apparatus is allowed to cool in a current of gas, and the liquid in the absorption tubes mixed. The sublimed mercury is washed out with hot nitric acid. The solution is evaporated to a small volume, treated with aqua regia to dissolve any mercury remaining, and then evaporated to dryness. The residue is dissolved in water and dilute nitric acid, the sulphuric acid estimated by precipitation with barium chloride, and the mercury weighed as sulphide. When the cinnabar is contaminated with silica, iron, or carbon, this method is especially convenient, as a clear solution is at once obtained.

Commercial crystalline tin sulphide is analysed in a similar manner to the above. The combustion is carried on until the tin dioxide remains unaltered; this is then weighed in the combustion tube.

E. C. R.

Drown's Method of estimating Sulphur in Pig Iron. By GEORGE AUCHY (*J. Amer. Chem. Soc.*, 1896, **18**, 406—411).—The author has slightly modified this process, and operates as follows. 3·4335 grams of the pig iron drillings is introduced into a 16-ounce flask connected with a Troilius' bulb containing 6 c.c. of a 1 per cent. solution of potassium permanganate and 6 c.c. of 20 per cent. aqueous potash. The iron is now dissolved in hot dilute hydrochloric acid, and finally air is drawn through the apparatus by means of a filter pump.

The contents of the bulb are now washed into a small beaker. The iron solution is filtered, and, after being washed, the insoluble residue is rinsed into an evaporating dish. After evaporating to dryness, 30 c.c. of nitrohydrochloric acid is added, and then again evaporated off. The mass is now heated with 10 c.c. of dilute hydrochloric acid, which is then filtered and added to the alkaline permanganate solution, which, of course, contains the greater part of the sulphur. To better reduce the excess of permanganate, a sufficiency of oxalic acid is added, and the liquid is boiled. The sulphuric acid is then precipitated in the usual way with barium chloride. Traces of silica in the potash, or a little undecomposed oxalic acid, do not in the least interfere. L. DE K.

Estimation of Pyrrhotite in Pyrites. By EDWIN F. CONE (*J. Amer. Chem. Soc.*, 1896, **18**, 404—407).—The author advises examining pyrites for the presence of pyrrhotite (Fe_7S_8), as this is of inferior value to makers of sulphuric acid.

The ground sample is passed through a 60-mesh sieve and 13·74 grams is then weighed and spread out upon a good-sized sheet of glazed paper. By means of a magnet, the pyrrhotite is removed, and by first stroking suddenly the top of the magnet, the mechanically admixed pyrites are separated, and the magnetic substance is then removed by means of the armature and a brush. The process is repeated five or six times, and the magnetic portion is then finely powdered and oxidised by means of nitric and bromohydrochloric acids. From the weight of the barium sulphate, the amount of Fe_7S_8 is calculated. L. DE K.

New Safety Distillation Tube for Nitrogen Estimations. By CYRIL G. HOPKINS (*J. Amer. Chem. Soc.*, 1896, **18**, 227—228).—This modification of Reitmeir's distillation tube for use in the Kjeldahl process differs from the usual pattern in so far that not only the tube which passes into the distillation flask, but also the tube within the bulb has an opening on the side, and a jet at the end. The vapour passes in through the side openings, and whatever condenses in the top part of the bent tube passes back into the flask through the jets.

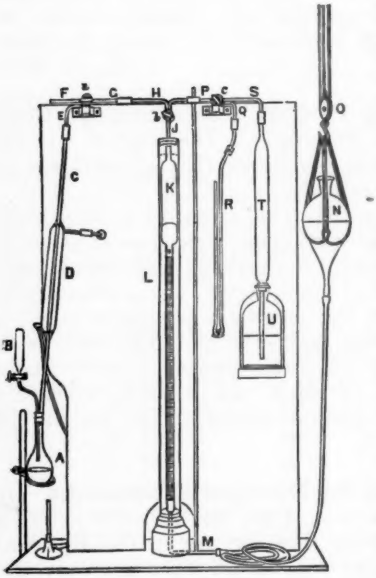
All danger of alkaline liquid being mechanically forced into the distillate is thereby avoided. L. DE K.

Modifications of Pemberton's Volumetric Method of estimating Phosphoric acid in Fertilisers. By F. P. VEITCH (*J. Amer.

Chem. Soc., 1896, **18**, 389—396).—The author has investigated the various modifications of Pemberton's volumetric molybdate process, and tabulated the results. The final conclusions are: (1) That the best results are obtained by adding 10 per cent. extra nitric acid to the official molybdate solution, and allowing this to act for half an hour at 40—50°. (2) That, although addition of tartaric acid gives good results, it possesses no advantage, and only retards the precipitation of the phosphoric acid. L. DE K.

[**Analysis of Silicates containing Fluorine.**] By ALFRED REICH (*Monatsh.*, 1896, **17**, 149—171).—See this vol., ii, 531.

Estimation of Carbon in Steel. By ANDREW A. BLAIR (*J. Amer. Chem. Soc.*, 1896, **18**, 223—227).—The 400-c.c. pipette T is connected by means of the stopcocks *b* and *c* with the burette K, and by lowering the mercury reservoir the pipette is filled with aqueous potash of sp. gr. 1·27. The stopcock *c* is closed, the burette filled with mercury, and *b* then closed. One gram of the steel drillings is introduced into the 200-c.c. flask A, which is then attached to the apparatus. The water is started through the condenser D, and the flask is connected with the burette by means of the stopcock *a*. 15 c.c. of a saturated solution of pure copper sulphate is poured through the funnel tube B into the flask. After it has acted long enough to form a superficial deposit of copper on the metal, 15 c.c. of a 50 per cent. solution of chromic acid and 135 c.c. of the following mixture is added: 35 c.c. of chromic acid solution, 115 c.c. of water, 750 c.c. of sulphuric acid, and 315 c.c. of phosphoric acid of 1·4 sp. gr. The solution in the flask is now raised to the boiling point, and, by means of the reservoir, the mercury in the burette and the tube M is kept nearly level. The water condensed in the tube C drops back into the flask, and keeps the liquid of the same density, while the cooled gases pass into the burette.



The flask is now allowed to cool for 5 minutes, and is then filled through the tube B with water to the stopcock *a*, thus forcing all the gas into the burette. The cock is then closed, and the burette is connected by means of the stopcocks *b* and *c* with the manometer R containing water; the levels are adjusted accurately, and the reading of the burette is taken. By means of the stopcock *c* the burette is connected with the pipette T, and by raising and lowering the reservoir N the gas is passed several times backwards and forwards to cause the alkali to absorb all the carbonic anhydride. Another reading is then made, care being taken that the burette contains a few drops of water, and the difference between the two readings represents the volume of the carbonic anhydride, which is then corrected for pressure, temperature, and moisture. The volume of the gas so obtained, multiplied by 0·0019663, gives the weight.

L. DE K.

Rapid and Exact Estimation of Lime in Soils. By A. NANTIER (*Ann. Agron.*, 1896, **22**, 245—246).—The soil (5 grams) is treated with 50 c.c. of acid (100 c.c. of acid = 5 grams of $CaCO_3$) in a cylindrical glass vessel, and heated rapidly to boiling for 4 or 5 seconds to expel the dissolved carbonic anhydride. Water (50 c.c.) and a few drops of litmus solution are added, and the liquid titrated. When saturated, the liquid becomes reddish-violet, and at the same time the clayey magma is instantly precipitated. The process is very accurate as well as rapid; two operators can easily make 20 determinations in an hour. N. H. J. M.

Quantitative Analysis by Electrolysis. By MAX HEIDENREICH (*Ber.*, 1896, **29**, 1585—1590).—The author has tested the methods given by Smith for the estimation of various metals by means of electrolysis. The only method, by means of which he has succeeded in getting good results, is that given for copper, whilst in the cases of iron, cadmium, silver, molybdenum, and uranium, the results were unsatisfactory. On the other hand, the separation of lead from mercury, and copper from zinc, in presence of nitric acid, and of silver from copper, silver from zinc, mercury from zinc, and mercury from nickel in presence of potassium cyanide all succeeded well. Silver cannot be separated from lead by the method described by Smith, nor copper from cadmium, although the latter separation can be effected in presence of sulphuric acid. A. H.

Delicate Form of the Mercury Iodide Reaction. By PAUL JANNASCH (*Zeit. anorg. Chem.*, 1896, **12**, 143—145).—The slightly acid solution of the mercury salt is treated with perfectly clean pieces of copper, and warmed in lukewarm water. The solution is then poured off, the copper washed with cold water, then turned out on to filter paper, and carefully pressed until dry. It is then transferred to a test tube, and the neck of the tube drawn out to a capillary. The copper is then heated until the sublimate has collected round the capillary. The bottom of the tube is cut off, and the upper part placed in a cylinder containing a small piece of iodine, when a deposit of red mercuric iodide is obtained. The tube can then be sealed at both ends and kept as a specimen. By this method 0·0005 gram of mercury chloride can be easily detected, but no certain result was obtained with 0·0001 gram. About 0·00001 gram of mercuric chloride can be detected if a copper strip, after treatment with the mercury solution and drying, is placed on a watch glass near to, but not touching, a small piece of iodine, and then covered with another glass for about

10 minutes. Rings of deposited mercuric iodide are formed on the copper, and these when examined under the microscope are seen to consist of dark red quadratic tablets or octahedra, which appear yellow when separated. E. C. R.

Separation of Mercury from other Metals by heating the Sulphides in a Current of Oxygen. By PAUL JANNASCH and H. LEHNERT (*Zeit. anorg. Chem.*, 1896, **12**, 132—133).—The same apparatus is employed as for the analysis of sulphides, the three absorption tubes being filled with dilute nitric acid. The separation of mercury and tin is carried out as follows. The metals are precipitated as sulphides, and the precipitate dried at 90°. The precipitate is separated from the filter paper, and the filter paper first burned in the apparatus, the bulk of the precipitate is then added, and the mercury distilled off, whereby white tin oxide remains behind and is weighed in the combustion tube. The mercury is precipitated as sulphide. This method is applicable to the separation of mercury from nearly all organic and inorganic mixtures containing it. E. C. R.

Separation of Manganese from Copper and Zinc, and of Copper from Zinc and Nickel. By PAUL JANNASCH (*Zeit. anorg. Chem.*, 1896, **12**, 134—142; compare Abstr., 1895, ii, 331).—*Separation of Manganese and Zinc.*—The metallic salts (0·4 gram) are dissolved in water (10—18 c.c.) containing a few drops of hydrochloric acid and mixed with acetic acid (15 c.c.). The mixture is then slowly added to a mixture of concentrated ammonia (40—50 c.c.) and 3 per cent. hydrogen peroxide (30—40 c.c.), and heated on the water bath for 10—15 minutes. The precipitate is washed with strong, then with dilute, ammonia, and finally with warm water. It is entirely free from zinc. The zinc is estimated in the filtrate by any convenient method.

Separation of Manganese and Copper.—The metallic salts (0·4 gram) are dissolved as above, and the solution gradually added to a mixture of ammonia (60 c.c.) and hydrogen peroxide (50—60 c.c.). The mixture is heated on the water bath for half an hour, filtered, and the precipitate washed with a hot solution of ammonium acetate in concentrated ammonia, and then with ammonia and water. The precipitate is entirely free from copper. The filtrate containing the copper is evaporated to dryness, heated on the air bath, and the copper precipitated either with sodium hydroxide or with sulphurous acid and ammonium thiocyanate.

The precipitate of copper sulphide obtained in an acid solution containing zinc by means of hydrogen sulphide always contains zinc. The author proceeds as follows. In the case of an alloy, about 1 gram is dissolved in nitric acid, the solution evaporated to dryness, and the residue dissolved in dilute nitric acid, and any tin oxide filtered off. The solution is again evaporated to dryness, and the residue dissolved in water and concentrated sulphuric acid (10 c.c.), diluted to 350 c.c., and the copper precipitated at 85—95° by hydrogen sulphide. The copper sulphide, which is quite free from zinc, is converted into oxide by heating in a current of oxygen. The filtrate containing the zinc is evaporated to 100—150 c.c., and the zinc precipitated with sodium carbonate. Nickel and zinc are separated as follows. The two metals are precipitated together as carbonates, the precipitate dissolved in hydrochloric acid, evaporated to dryness, dissolved in water containing at most 10 drops of hydrochloric acid, and the solution gradually added to a warm solution of pure sodium hydroxide. The mixture is boiled, diluted with water, and the precipitated nickel separated by filtration.

The author discusses the advantages of the alkaline hydrogen peroxide method of separation as compared with the ordinary methods. E. C. R.

Särnström's Method of estimating Manganese in Iron Ores. By C. T. MIXER and H. W. DUBOIS (*J. Amer. Chem. Soc.*, 1896, **18**, 385—389).—The process is based on the well-known fact that manganese is not precipitated from strongly acid solutions by sodium carbonate, whilst iron is readily thrown down.

The author finds that in the case of ores poor in manganese the process gives excellent results if care is taken to avoid excess of sodium carbonate. The use of the bicarbonate has no practical advantage. After the iron hydroxide has subsided, the liquid is at once warmed to 80°, and titrated with standard permanganate.

For ores rich in manganese, the method is untrustworthy.

L. DE K.

Volumetric Estimation of Manganese. By GEORGE C. STONE (*J. Amer. Chem. Soc.*, 1896, **18**, 228—229).—The author thinks that Volhard's method as modified by Auchy (this vol., ii, 339) is unnecessarily complicated, and states that the process gives very accurate results if used as follows.

The quantity of manganese should amount from 0·05—0·15 gram. The sample of iron is dissolved in a suitable acid, but care must be taken to thoroughly oxidise the iron by boiling with nitric acid, or hydrochloric acid and potassium chlorate. After cooling, the solution is mixed with a sufficiency of an emulsion of zinc oxide, and then made up to exactly 500 c.c. When the precipitate has subsided, 100 c.c. of the liquid is put into a basin, diluted to 200 c.c., heated to boiling, and rapidly titrated with standard permanganate while vigorously stirred. L. DE K.

Separation of Metals in Alkaline Solution by means of Hydrogen Peroxide. XV. By PAUL JANNASCH and H. LEHNERT (*Zeit. anorg. Chem.*, 1896, **12**, 124—128).—*Separation of Arsenic and Cobalt.*—A solution of cobalt ammonium sulphate and arsenious acid in nitric acid (2 c.c.) and water (10 c.c.) is gradually added to a solution of pure sodium hydroxide (10 grams) in water (20—25 c.c.), mixed with 3 per cent. hydrogen peroxide (30 c.c.). The mixture is warmed for half an hour on the water bath, diluted with hot water to about 250 c.c., and the precipitate of cobalt hydrated peroxide filtered off, washed with hot water, dried, ignited, and weighed as cobalticobaltous oxide, then reduced to metallic cobalt, and again weighed. The filtrate containing the arsenic is acidified with concentrated nitric acid, evaporated to a small volume, mixed with 2 grams of citric acid, and made strongly alkaline with ammonia, when no precipitate should be obtained even on standing. The arsenic is then precipitated with magnesium chloride, and the precipitate washed with dilute ammonia and dried at 90°. The precipitate is separated from the filter paper, the last traces being dissolved off with nitric acid; this solution is evaporated to dryness, and the bulk of the precipitate added and ignited. Arsenic and nickel are separated in a similar manner.

Separation of Manganese and Cobalt.—A solution of manganese and cobalt ammonium sulphates (0·4 to 0·5 gram) in water (10—15 c.c.) containing a few drops of hydrochloric acid is gradually added to a cold solution of sodium hydroxide (6 grams) and pure potassium cyanide (3·5 grams) in water (50 c.c.); a 3—5 per cent. solution of hydrogen peroxide (20—25 c.c.) is then added, and the mixture warmed on the water bath for half an hour. It is then diluted to 250—300 c.c., and the precipitated manganese collected and thoroughly washed with hot water. The precipitate is dissolved in dilute hydrochloric acid and hydrogen peroxide, again precipitated with ammoniacal hydrogen peroxide, collected, ignited, and weighed as Mn_3O_4. The filtrate containing the cobalt is acidified with concentrated sulphuric acid and evaporated to complete dryness, whereby the cobalt potassium cyanide is converted into sulphate. The residue is dissolved in hot water, and the cobalt precipitated as hydrated peroxide with a solution of sodium hydroxide and hydrogen peroxide, and finally weighed as Co_3O_4 and Co. It is important that the potassium cyanide is pure, as otherwise the precipitates are contaminated with iron; also the solution becomes contaminated with small quantities of silica, which is separated after the evaporation with sulphuric acid. The separation of manganese and nickel is effected in a similar way.

Estimation of Tin.—A solution of the chloride, $SnCl_4(NH_4Cl)_2$ (0·4—0·5 gram), in water (10 c.c.) containing a few drops of hydrochloric acid, is gradually added to a mixture of water (20 c.c.), concentrated nitric acid (10 c.c.), concentrated ammonia (40 c.c.), and hydrogen peroxide (25—30 c.c.). The mixture is heated on the water bath until the precipitate has completely settled; it is then filtered, and the precipitate washed with a 10 per cent. faintly ammoniacal solution of ammonium nitrate, dried at 95°, ignited, and weighed as SnO_2. The filtrate, when treated with ammonium sulphide and then with hydrochloric acid, gives no precipitate of tin sulphide.

E. C. R.

Detection of Chromates and Arsenites. By N. Tarugi (*Gazzetta*, 1896, **26**, i, 220—222).—The author replies to Antony's criticisms (this vol., ii, 390).

W. J. P.

Estimation of the Colours of Natural Waters. By Allen Hazen (*J. Amer. Chem. Soc.*, 1896, **18**, 264—275).—The author prepares a comparison liquid by dissolving platinum chloride in water, and adding a sufficiency of cobalt chloride so as to obtain the desired shade of colour.

The colouring matter in the sample is then expressed in degrees of platinum-cobalt. L. DE K.

Detection of Lead and Copper in Potable Waters.—By CORNELIS GULDENSTEEDEN EGELING (*Ned. Tydschr. Pharm.*, &c., 1896, 113—117).—Two hundred and fifty c.c. of the water is acidified with acetic acid, and hydrogen sulphide is passed through it; 0·5 gram of talc which has previously been boiled with dilute nitric acid is then added and the mixture well shaken. The talc as it settles carries down with it even the merest traces of lead or copper sulphide which may have been present. The liquid is poured off, the deposit collected on a cotton-wool filter, and treated with a few c.c. of hot nitric acid. The acid is then evaporated to dryness in a small dish, and the residue tested for copper and lead in the usual way. L. DE K.

Estimation of Small Quantities of Lead in Water. By UBALDO ANTONY and T. BENELLI (*Gazzetta*, 1896, **26**, i, 218—220).—In determining small quantities of lead in water, it is advisable to add a considerable proportion of mercuric chloride to a measured volume of the sample, and then treat with excess of hydrogen sulphide; after adding ammonium chloride to ensure the deposition of all the mercuric sulphide, the bulk of the liquid is removed by decantation, the sulphide collected on a filter, dried, and the residue heated either in a current of hydrogen sulphide and weighed as lead sulphide, or in the air, treated with sulphuric acid and weighed as lead sulphate. The addition of the mercuric chloride prevents the lead sulphide assuming the colloïdal soluble form; test analyses gave excellent results. W. J. P.

Estimation of Sodium Salicylate in Presence of "Ichthyol." By J. J. HOFMAN (*Ned. Tydschr. Pharm.*, &c., 1895, 103—104).—The sodium salicylate may be separated from the ichthyol by treating the mixture with water, which will leave the greater part of the ichthyol undissolved, and the last traces may be precipitated from the solution by adding an equal bulk of brine. The salicylic acid can then be extracted in the usual manner by acidifying with hydrochloric acid and agitating with ether. L. DE K.

Determination of the Heat of Bromination in Oils. By HARVEY W. WILEY (*J. Amer. Chem. Soc.*, 1896, **18**, 378—383).—The process is a modification of the one proposed by Hehner and Mitchell (Abstr., 1895, ii, 427). The bromine is not added undiluted, but is mixed with 4 volumes of either chloroform or, better, carbon tetrachloride.

Ten grams of the oil is dissolved in either of the solvents and diluted to 50 c.c.; 5 c.c. of this solution is mixed in a specially constructed apparatus with 5 c.c. of the bromine solution, and the rise in temperature is observed by means of a delicate thermometer. The author has tabulated the results of experiments with olive oil, calycanthus seed oil, cotton-seed oil, and sunflower seed oil, using both chloroform and carbon tetrachloride. It is advisable to make at least four trials with a sample. L. DE K.

Estimation of the Solid Fat in Artificial Mixtures of Vegetable and Animal Fats and Oils. By J. HOWARD WAINWRIGHT (*J. Amer. Chem. Soc.*, 1896, **18**, 259—264).—The author recommends the following process for the assay of lard compounds (larderine) :—150 grams of the sample is placed in a beaker and heated in a boiling water bath until entirely melted. After an hour, the water is allowed to cool to 75—80 F., and the beaker is then put in a moderately warm place for at least 12 hours. This causes the solid fat to crystallise, and after stirring the contents with a glass rod or spatula, 50 grams is weighed out and carefully wrapped in a double thickness of Canton flannel in which it is subjected to pressure in a small screw press, very gradually at first but afterwards as strongly as possible. After the oil has drained off, the contents of the press are removed and the solid cake is weighed.

The results are accurate within one and a half per cent.

L. DE K.

Estimation of added Water in Milk by taking its Freezing Point. By HARTOG J. HAMBURGER (*Ned. Tydschr. Pharm.*, 1896, 209—212).—The author finds that the freezing point of milk varies from 0·574 to 0·556° below zero.

By using Beckmann's freezing apparatus and a thermometer capable of showing hundredths of a degree or less, it becomes possible to detect with certainty the addition of 2 or 3 per cent. of added water. Several samples of milk may be tested in an hour.

The author is fully aware that before the process can be generally introduced, a great many local experiments will have to be made.

L. DE K.

New Method of Testing Quinine. By MELCHIOR KUBLI (*Chem. Centr.*, 1895, ii, 1058—1059; from *Pharm. Zeit. Russ.*, **34**, 593—598, 609—613, 625—628, 641—646).—The author's process for testing commercial quinine sulphate is based on the fact that whilst the sulphates of the inferior alkaloïds are more soluble in water than the pure article, the liberated alkaloïds behave in an opposite manner.

1·793 gram of the sample dried at 40—50° is placed in a tared flask with 60 c.c. of water and heated to boiling. After five minutes, the amount of water is increased to 62 grams, and the whole is placed for half an hour in water at 20°, well shaken and filtered. 5 c.c. of the filtrate is put into a narrow glass cylinder, three drops (0·8 c.c.) of a solution of sodium carbonate (1—10) is added, and water is now carefully added from a burette, with constant shaking, untii the turbidity has completely disappeared. The operation is twice repeated, and, to make sure, the supposed correct amount of water is added at once, and the turbidity should then vanish by rotating three times. If the sample is pure, 10 c.c. of water will be required; but, if not, a larger quantity will be wanted, depending on the quantity and nature of the accompanying alkaloïd. The paper will be continued.

L. DE K.

The Testing of Quinine Sulphate. By OSWALD HESSE (*Arch. Pharm.*, 1896, **234**, 195—203).—The author criticises the water test and the carbonic anhydride test proposed by Kubli (preceding abstract), and points out that, according to his own experiments, neither of these tests gives such accurate results as the official tests, and further, that the results given by the two tests do not agree with one another. A. H.

Acidimetric Estimation of Vegetable Alkaloïds. A Study of Indicators. By Lyman F. Kebler (*J. Amer. Chem. Soc.*, 1895, **17**, 822—831).—The author has experimented with the following alkaloïds: quinine, strychnine, morphine, codeïne, and cocaïne; also with the crude alkaloïds of nux vomica, ipecacuanha, and belladonna.

As regards the indicators, it can be safely concluded that methylorange has lost somewhat of its glory. Litmus solution is also quite unsatisfactory for delicate titrations. Hæmatoxylin may claim the best results, whilst Brazil wood comes second, and cochineal third. The author is studying the behaviour of other indicators.

L. de K.

A Forensic Examination for Strychnine. By Louis Lewin (*Arch. Pharm.*, 1896, **234**, 272—273).—Polemical. A. H.

Detection of the Glucosides of Digitalis and the Products of their Hydrolysis by means of Sulphuric acid containing a Ferric Salt. By Heinrich Kiliani (*Arch. Pharm.*, 1896, **234**, 273—277).—The reaction which the digitalis glucosides give with sulphuric acid is due to the presence of ferric salts in the latter, and is best obtained by using sulphuric acid, to 100 c.c. of which 1 c.c. of a solution of 5 grams of commercial ferric sulphate in 100 c.c. of water has been added. With this reagent the following reactions may be obtained.

Digitalinum verum is coloured a deep golden yellow, and then forms a red solution, which rapidly changes to a permanent reddish-violet. Digitaligenin gives the same reaction, but with greater intensity. Digitoxin becomes very dark coloured, and then forms a dirty brownish-red solution. Digitoxigenin forms a red solution which is strongly fluorescent. Digitonin and digitogenin, on the other hand, produce no coloration whatever.

Digitoxin may be further identified by the fact that, when it is dissolved in acetic acid containing ferric sulphate (prepared in the same way as the sulphuric acid), and sulphuric acid containing the iron salt then poured into the tube so as to form a layer beneath it, a blue coloration is gradually developed in the acetic acid, whilst the sulphuric acid remains colourless. This coloration in the acetic acid is not produced by any other of these compounds. If digitalinum verum is also present, the sulphuric acid becomes reddish-violet, and the acetic acid indigo-blue. (Compare Keller, *Ber. Pharm. Gesell.*, 1895, Part 11.) The application of this very delicate test has shown that no digitoxin is present in the glucosides extracted from the seeds in the ordinary way.

Digitoxin appears only to exist in one modification, the substance described as α-digitoxin being identical with the β-compound previously described by the author. A. H.

Cubebs and its Adulterants. By KARL PEINEMANN (*Arch. Pharm.*, 1896, **234**, 204—271).—See this vol., i, 494.

F. Hoppe-Seyler's Double Colorimetric Pipette. By GEORG HOPPE-SEYLER (*Zeit. physiol. Chem.*, 1896, **21**, 461—467), and by HUGO WINTERNITZ (*ibid.*, 468—480).—The more extensive use of this apparatus is advised. In the first paper, a number of clinical examinations of blood are given. Hoppe-Seyler's method gives higher results than the other well-known colorimetric methods of Gowers and von Fleischl. The second paper shows that the standard used (carbonic oxide hæmoglobin) is permanent for years, and that the colorimetric results are close to those obtained by analysis. Various details in the method of using the instrument are described in full.

W. D. H.

Estimation of Solid Matter in Beef-Tea. By LEONARD DE KONINGH (*Ned. Tydschr. Pharm., &c.*, 1896, 208).—To a weighed quantity of the warm liquid, a weighed quantity of tannin is added, the moisture in which is, of course, known. The gelatin is at once precipitated and the drying therefore proceeds at a rapid rate on the water bath; a short drying at 98—100° will then give a constant weight from which the weight of the dry tannin added must be deducted. The combination of gelatin with tannin is, according to the author, a purely additive product. The residue is, as a rule, more combustible than that obtained in the ordinary way, and leaves a white ash.

L. DE K.

General and Physical Chemistry.

Characterisation of Optically Isomeric Compounds. By Paul Walden (*Ber.*, 1896, **29**, 1692—1707).—According to Pasteur, substances containing an asymmetric carbon atom all crystallise in hemihedral forms. This statement can no longer be maintained, since a very large number of optically isomeric compounds are now known which do not crystallise in hemihedral forms, a large number of these from among the alkaloïds, sugars, and terpenes being adduced by the author. Numerous cases, moreover, are now known in which the racemic inactive form of a compound does not differ from the active forms in the same way as racemic acid from dextro- and lævo-tartaric acid, by having a higher melting point and smaller solubility. Thus, many racemic forms have the same melting point, and others again a lower melting point than the optically active isomerides to which they correspond. The author has determined the melting point, density, molecular volume, electrical conductivity (coefficient of affinity), solubility, and crystalline form of a large number of optically active substances and of their racemic isomerides, and has come to the following conclusions. (1) Hemihedry is only a frequent, but not a necessary, accompaniment of optical activity. (2) Both the optically active and racemic forms have the same coefficient of affinity (K). (3) The dextro- and lævo-forms of a substance have the same density, solubility, and melting point. (4) The racemic form may have either the same or a lower or a higher melting point than the active isomerides. (5) When the racemic form has a higher melting point it has also a smaller solubility and a smaller molecular volume. (6) Any compound of two oppositely optically active forms of a substance may be considered as a true racemic modification when its crystalline form and density is different from those of the active isomerides. These are usually accompanied by different melting point and solubility.

A. H.

Chlorinated Ethereal Tartrates. By Paul Freundler (*Bull. Soc. Chim.*, 1895, [3], **13**, 1055—1063).—Le Bel (*ibid.*, **9**, 674) and Walden (Abstr., 1895, i, 450) have shown that optically active substances which contain an atom of chlorine, bromine, or iodine directly united to an asymmetric carbon atom form exceptions to Guye's law of the product of asymmetry. Le Bel has found that the chloracetate of propyl glycol, in which the chlorine is not directly united to an asymmetric carbon atom, does not behave abnormally; the author has undertaken the study of several ethereal salts of tartaric acid, in which the hydroxyls have been etherified by chloracetic acid, in order to see whether they are also normal.

Methylic dichloracetyltartrate,

$$COOMe\cdot CH(COOCH_2Cl)\cdot CH(COOCH_2Cl)\cdot COOMe,$$

is a syrupy liquid, which distils at 187—190° under a pressure of 14 mm. Its sp. gr. = 1·409 at 18°, and its specific rotatory power $[\alpha]_D = +3·5°$. The corresponding *ethylic* salt boils at 195—197° at 12 mm. pressure, has sp. gr. = 1·311 at 15°, and $[\alpha]_D = +9·4°$. The *propylic* salt boils at 204—205° at 15 mm. pressure; its sp gr. = 1·245 at 17° and $[\alpha]_D = +11·6°$. The *isobutylic* salt is almost as syrupy as the methylic; it distils at 210—215° at 13 mm. pressure; its sp. gr. = 1·195 at 20°, and its specific rotatory power $[\alpha]_D = +13·9°$. These numbers are normal, in so far as the rotatory power increases with an increase in weight of the alkylic group, but they are abnormal in that they are all dextrogyrate, whereas from the law of the product of asymmetry they should be lævogyrate. The author discusses these facts from a theoretical standpoint. Experiments were also made to show the influence of temperature on the rotatory power; in all cases, the rotatory power increases considerably with an increase in temperature.

Different solvents also have an influence on the rotatory powers of these ethereal salts, just as they have on those of the diphenylacetyltartrates and the ordinary alkylic tartrates.

				Benzene solution.	Liquid.
Methylic	dichloracetyl	tartrate	$[\alpha]_D$	= − 1·1°	+ 3·5°
Ethylic	„	„	$[\alpha]_D$	= +10·8	+ 9·4
Propylic	„	„	$[\alpha]_D$	= + 9·9	+11·6
Isobutylic	„	„	$[\alpha]_D$	= + 8·0	+13·9

Alcohol, carbon bisulphide, ethylene dibromide, and chloroform have the same effect on the rotatory powers of the dichloracetyltartrates as on those of the diphenylacetyltartrates.

The molecular weights, as obtained by the cryoscopic method, in benzene and ethylene dibromide solutions, are also abnormal.

J. J. S.

The Action of Nitrous acid in a Grove's Element. By Rudolph Ihle (*Chem. Centr.*, 1895, ii, 428; from *Zeits. Electrotechn. u. Etectrochemie*, 1895, 174—175).—If the nitric acid in a Grove's element is gradually diluted with water, the electromotive force remains nearly constant until the acid contains 38 per cent. nitric acid; on further dilution, the E.M.F. falls from 1·8 to 0·7 volt, and with 28 per cent. of nitric acid has the smaller potential. If, however, potassium nitrite is added to the 28 per cent. acid, the potential rises from 0·7 to 1·8 volt, but falls again to 0·7 as soon as the nitrous acid is destroyed by potassium permanganate, hydrogen peroxide, carbamide, &c. Similarly the potential of a >38 per cent. acid is lowered by the addition of potassium permanganate or of carbamide. It therefore follows that nitrous acid is the real depolariser in a Grove's element (compare this vol., ii, 460). J. J. S.

A Non-sulphating Phospho-accumulator. By Henry N. Warren (*Chem. News*, 1896, **73**, 191).—Lead grids of special construction are repeatedly pasted with a composition of litharge and phosphoric and sulphuric acids, and dried for hours at 250° F., until biscuit plates are obtained; these are piled with alternate plates of amalgamated zinc and insulating carbon blocks in dilute sulphuric acid, with or without 12 per cent. of phosphoric acid, until perfectly reduced; they are then washed and peroxidised, being subsequently soaked in dilute phosphoric acid. D. A. L.

Electrolysis of Hydrogen Chloride without a Membrane. By FELIX OETTEL (*Chem. Centr.*, 1895, **76**, 3; from *Zeits. Elektrotechn. u. Elektrochemie*, 1895, 57—58).—If hydrogen chloride is electrolysed without a membrane, the decomposition products are formed in amounts far below the theoretical, as the chlorine which dissolves in the liquid is again converted into hydrogen chloride by the hydrogen at the cathode. The solubility of the chlorine in the solution is reduced by the addition of sodium chloride, magnesium chloride, or magnesium sulphate. The most suitable solution for electrolysis is a concentrated solution of sodium chloride to which sulphuric acid has been added. If the sulphuric acid is added in excess, oxygen is liberated towards the end of the process; if sodium chloride is in excess, sodium hypochlorite is formed, and the evolution of gas ceases when the solution becomes neutral. H. C.

Calculation of the Conductivity of Mixtures of Electrolytes having a common Ion. By DOUGLAS McINTOSH (*Phil. Mag.*, 1896, [5], **41**, 510—516).—MacGregor has developed a method of calculating, from observations of a number of simple solutions of two electrolytes having a common ion, the conductivity of a solution containing both electrolytes, the assumption being made that the ionic velocities of the constituent electrolytes are not changed by the mixing. To test the accuracy of the method, the author has examined mixtures of sodium and potassium chloride solutions, and of solutions of sodium and hydrogen chloride. In the case of mixtures of sodium and potassium chlorides, the differences between the calculated and the observed values increase rapidly as the constituent solutions become more and more nearly saturated, reaching 6·4 per cent. in the case of practically saturated solutions. In the weaker solutions of sodium and hydrogen chloride, the differences between the calculated and observed values are evidently due to accidental errors; in the stronger solutions, the differences become more marked and irregular in magnitude.

The results show that in the case of two electrolytes with a common ion which differ so markedly in ionic velocity from one another as sodium chloride and hydrogen chloride, the dissociation theory enables us to calculate the conductivity of solutions containing both, within the limits of experimental error, up to a mean concentration of about 1 gram.-mol. per litre, and that in the case of solutions of greater mean concentration the calculated value is greater than the observed. H. C.

Conductivity of Solutions of some Salts in Acetone. By ST. VON LASZCZYNSKI (*Chem. Centr.*, 1895, **76**, 3; from *Zeits. Elektrotechn. u. Elektrochemie*, 1895, 55—57).—The author has determined the conductivities of solutions of the thiocyanates of potassium, sodium, and ammonium, the chlorides of mercury and potassium, potassium iodide, and silver nitrate in acetone, the conductivity of which was itself negligeable. The values obtained for various dilutions show that solutions in acetone have a smaller conductivity than the corresponding aqueous solutions. The resistances increase with rising dilution in such a manner as to prevent the determination of the limiting value for the molecular conductivity, but the values for μ_∞ are estimated at 160—170 for potassium iodide and >200 for sodium thiocyanate.

In agreement with Ostwald's view, that the differences in the molecular conductivities depend on the internal friction of the solvents, acetone solutions show higher values for μ_∞ than aqueous solutions.

H. C.

Electrolysis of Solutions of Salts in Acetone. By St. von Laszczynski (*Chem. Centr.*, 1895, **76**, 3; from *Zeits. Elektrotechn. u. Elektrochemie*, 1895, 57).—A solution of potassium iodide in acetone can be decomposed by the current from six Meidinger cells; iodine appears at the anode and a gas at the cathode. A solution of lithium chloride electrolysed with 100 volts yields lithium at the cathode. The thiocyanates of potassium, sodium, and ammonium give with 7 volts and 0·5 ampère the corresponding amalgam when mercury is used as the cathode; with copper or platinum cathodes a yellow, amorphous deposit is formed, and bubbles of gas appear on both electrodes. From a silver nitrate solution, the metal separates on the cathode.

H. C.

Estimation of the Heat of Combustion of Fuels. By Walther Hempel (*Zeit. angw. Chem.*, 1896, 350—352).—The material, coal, for instance, is burnt in a calorimetric bomb. The bomb is then heated, and the steam passed into a weighed calcium chloride tube, to which a calcium chloride guard tube has been attached. To collect all the water, the guard tube is connected with a filter pump, and the bomb exhausted. By alternately admitting air and exhausting, the last traces of water may be collected in the weighed tube. The available heating effect is then found by allowing 600 calories for each unit of water.

L. de K.

Reaction Velocity in the Conversion of Diazoamido- into Amidoazo-derivatives. II. By Heinrich Goldschmidt and R. U. Reinders (*Ber.*, 1896, **29**, 1899—1907; compare this vol., ii, 515).—Benzenediazoamidotoluene is converted by aniline hydrochloride in aniline solution into amidoazobenzene, and not into tolueneazoaniline. The conversion of paradiazoamidotoluene into amidoazotoluene in paratoluidine solution by paratoluidine hydrochloride proceeds in the normal manner, the rate of change being proportional to the concentration of the hydrochloride of the base.

Experiments with the hydrochloride, trichloracetate, and dichloracetate of aniline and diazoamidobenzene show that the rate of change is roughly proportional to the rate of inversion of sugar produced by the corresponding acids in aqueous solution. The authors therefore consider it probable that the effective agent in the production of the change is the hydrogen ion of the acid combined with the anilide, and that aniline hydrochloride is decomposed in aniline solution into the acid and the base. This view is supported by the fact that the solubility of hydrogen chloride in aniline is raised by the addition of indifferent compounds to the aniline in the same way as that of hydrated salts in water. The same thing holds for solutions of picric acid in toluidine. A further confirmation of this view is that diazoamidobenzene is converted into amidoazobenzene in dimethylaniline solution by weak acids, such as benzoic acid, which crystallise out in the free state from solution in dimethylaniline. A. H.

Note.—The authors do not discuss the possibility that the change may be brought about by the "ammonium ion" $C_6H_5{\cdot}NH_3$, of the dissociated salt.—A. H.

Etherification of Substituted Acetic acids. By D. M. Lichty (*Amer. Chem. J.*, 1896, **18**, 590—600; compare Abstr., 1895, ii, 159). A temperature of 80° was deemed more suitable than that previously used (154°; *loc. cit.*) for the determination of etherification values, and for the sake of better comparison than could be obtained by the former method, the estimations were made at much shorter intervals, namely, 1, 3, 5, 10, &c., minutes, instead of 1, 2, 4, 6, &c., hours. The following results were obtained.

	Initial rate (one minute).	Limit of etherification.
Chloracetic acid	1·78 per cent.	68·65 per cent.
Dichloracetic acid	4·56 „	71·22 „
Trichloracetic acid	9·99 „	74·00 „

The limit of etherification of acetic acid is 66·57 per cent. It will be seen that the influence of chlorine is much greater on the rate of etherification than on the limit. A. G. B.

Apparatus for Distillation in a Vacuum. By Paul C. Freer (*Amer. Chem. J.*, 1896, **18**, 585—586).—An improved receiver for distillation in a vacuum in which the receiving tubes are contained in a bell-mouthed cylinder closed at the shoulder by a gutta-percha plug, through which pass the condensing tube, the rotatory shaft which carries the receiving tubes, and the tube connected with the vacuum pump; the bell mouth of the cylinder contains mercury, which forms an air-tight layer over the gutta-percha plug. A. G. B.

Apparatus for the Electrolysis of Hydrochloric acid. By George O. Higley and B. J. Howard (*Amer. Chem. J.*, 1896, **18**, 584—585).—An improved apparatus for demonstrating the volumetric composition of hydrochloric acid by electrolysis, in which the liberated gases traverse but a small layer of liquid, and are collected and measured in tubes distinct from those containing the electrodes. A. G. B.

Lecture Experiment: Electrolysis of Hydrochloric acid. By J. M. Pickel (*Ber.*, 1896, **29**, 1942—1945; compare L. Meyer, Abstr., 1894, ii, 232).—The production of less chlorine than hydrogen when hydrochloric acid is electrolysed in a lecture experiment, has been already explained, and to some extent obviated by L. Meyer (*loc. cit.*). The author describes a form of apparatus in which the electrolyte is the only liquid through which the escaping chlorine must travel; the gas itself is not measured, but is caused to displace its own volume of air, which can then be estimated. By means of the new apparatus, a lecture experiment yields results which approximate closely to those required by theory. M. O. F.

Apparatus for demonstrating that two Volumes of Hydrogen and one Volume of Oxygen form two Volumes of Water Vapour. By Paul C. Freer (*Amer. Chem. J.*, 1896, **18**, 586—587). —An improved tube for demonstrating the volumetric composition of steam in which the eudiometer tube has a stopcock at its upper end, and is attached to a flexible tube from a mercury reservoir at its lower end. A. G. B.

Volumetric Composition of Ammonium Chloride. By Douglas John Carnegie and H. Wales (*Chem. News*, 1896, **73**, 206). —A tube is used, open below, stoppered at the top, and divided by a stopcock into two portions, so that the lower portion down to a mark is of twice the capacity of the upper portion. The upper portion is filled with dry hydrogen chloride, the lower portion with kerosene, saturated with dry ammonia; it is inverted in a glass trough containing the same liquid, and then filled down to the mark with dry ammonia; on opening the stopcock combination ensues, and in course of time the lower portion of the tube becomes filled with the kerosene, whilst the upper portion contains the ammonium chloride and the excess of ammonia, 1 vol. D. A. L.

Inorganic Chemistry.

Ozone. By Carl Engler and W. Wild (*Ber.*, 1896, **29**, 1929—1940).—Various hypotheses have been advanced to account for the production of a mist when ozone is led through a reducing agent and brought in contact with water vapour. It has, for instance, been stated that oxygen, when electrified, yields two modifications, ozone and antozone, the latter being characterised by producing the mist in question on removal of the former; this view was shown to be incorrect by Engler and Nasse, who pointed out that the hypothetical antozone was only formed on decomposing the ozone, at the same time suggesting that the fog producer is not a modification of oxygen, but the vapour of hydrogen peroxide. The present investigation indicates that this conclusion in turn has no experimental foundation, having established the fact that the fog under discussion consists of definite chemical compounds, usually solids, produced by the oxidation of a deozoniser. These substances are finely divided, or in some cases develop mist, owing to their hygroscopic properties; they may be acidic, neutral, or even basic, and escape absorption by water or alkalis entirely from mechanical causes.

The production of mist is found to depend on the presence in the deozoniser of a gaseous, or readily volatile substance, capable of yielding a solid, or hygroscopic, product of oxidation. Thus the phenomenon is observed in the case of solutions containing iodine, or from which iodine is liberated under the influence of ozone, this being oxidised to iodic acid; sulphurous acid yields sulphuric acid, whilst ammonia and solutions of ammonium salts give rise to ammonium nitrate. Liquids containing hydrogen sulphide owe their fog-producing character to the liberation of sulphur.

For the experimental evidence on which these conclusions are based, together with the explanation of minor points in connection with this phenomenon, reference must be made to the original paper.

M. O. F.

Oxidation of Sodium Sulphide and Hydrosulphide to Sulphate by Electrolysis. By FRANK W. DURKEE (*Amer. Chem. J.*, 1896, **18**, 525—536).—During the electrolysis of a dilute solution of sodium sulphide (containing about 3·4 grams of sodium in 400 c.c.) by a current of about 3 ampères (voltage not given), hydrogen was evolved at the cathode, and the liquid became yellow, at first around the cathode and ultimately throughout; light yellow sulphur then appeared on the anode, but scaled off again, and in greater part dissolved; fine white sulphur next separated near the surface of the liquid about the anode, but dissolved as it sank through the solution until a certain stage of the electrolysis, when the yellow colour of the liquid disappeared, and the white sulphur settled in the beaker; subsequently more oxygen escaped than at at any previous stage. Experiments, in which sodium thiosulphate solution and sodium polysulphide solution respectively were electrolysed, showed that the separation of white sulphur described above connotes the oxidation of thiosulphate, whilst the separation of yellow sulphur is incidental to the presence of polysulphide. These facts, in conjunction with the analytical data given in the paper, indicate that the course of oxidation of sodium sulphide by electrolysis is similar to that of its oxidation by air, which has been elucidated by Lunge; the sulphide is first oxidised to hydroxide and thiosulphate, the latter passing to sulphate with separation of sulphur; this sulphur dissolves in unaltered sulphide to form polysulphides, which are oxidised to thiosulphate with separation of sulphur. Thus during the electrolysis, sulphides disappear first, then the hydroxide, and finally the thiosulphate, the sulphate being virtually the end product. It was noticed that when attempts were made to electrolyse sodium sulphide solution with an alternating current, the platinum electrodes dissolved, whereas no such dissolution was noticed in the case of the direct current electrolysis.

A. G. B.

Volatility of Red Phosphorus. By HENRYK ARCTOWSKI (*Zeits. anorg. Chem.*, 1896, **12**, 225—228).—When commercial red phosphorus is heated for 10 days at a temperature of 108° in an apparatus so arranged that the volatile products are condensed on a cold tube, crystal skeletons are obtained, consisting of nodules of yellow phosphorus, containing small pieces of the red modification. Red phosphorus, previously washed with carbon bisulphide, when heated at 100° for 48 hours in a vacuum of 14—16 mm., volatilises, and forms carmine-red, transparent, microscopic crystals, which are not, however, well formed. E. C. R.

Action of Hydrogen Iodide and of Phosphonium Iodide on Thiophosphoryl Chloride. By ADOLPHE BESSON (*Compt. rend.*, 1896, **122**, 1200—1202).—Hydrogen iodide dissolves without change in thiophosphoryl chloride cooled in a mixture of ice and salt, but at 0° hydrogen chloride and hydrogen sulphide are given off, and the liquid contains free iodine and phosphorus triiodide, the action being analogous to that of hydrogen iodide on phosphorus oxychloride (this vol., ii, 472).

In sealed tubes at temperatures above 0°, the reaction is more complex, and the products depend on the temperature. In all cases iodine is liberated, hydrogen chloride and sulphide are given off, and the liquid contains phosphorus triiodide and a mixture of phosphorus trisulphide and pentasulphide in varying proportions, together with small quantities of the thioiodide, P_2SI_2, an orange solid, which melts at about 75°, and is very soluble in carbon bisulphide. The thioiodide does not sublime in a vacuum, decomposes when exposed to air, and readily when heated. In order that it may be formed in appreciable quantity, the solution of hydrogen iodide in the thiophosphoryl chloride must not be heated above 30—40°.

Phosphorus trisulphide is formed in very small quantity only by the action of hydrogen sulphide on phosphorus triiodide. It is, however, formed by the action of phosphonium iodide on thiophosphoryl chloride, and the author considers that an unstable thiophosphoryl iodide, PSI_3, is first formed, and subsequently decomposes into the trisulphide, triiodide, and free iodine. C. H. B.

Crystalline Silicon. By GUILLAME J. L. DE CHALMOT (*Amer. Chem. J.*, 1896, **18**, 536—540).—The author finds that the mixture of silica, lime, and carbon, which he heats in an electric furnace for the purpose of obtaining calcium silicide and crystalline silicon (this vol., ii, 473), yields very little of the former product unless it contains iron. The mixture of silicide and silicon is specifically lighter than the slag, and, moreover, tends to move towards the cathode; hence separation is aided if the furnace be upright and the cathode the upper electrode. Mixtures containing Mn_3O_4, quartz, charcoal, and lime, when heated in the electric furnace, yielded mixtures consisting mainly of a manganese silicide, probably $MnSi_2$, and crystalline silicon, which were separated by treatment with hydrofluoric acid and hydrochloric acid; the yield of silicon was 33 per cent., and it contained 97·77 per cent. of silicon, and was free from manganese. A. G. B.

Action of Metals on Nitric acid. By GEORGE O. HIGLEY and W. E. DAVIS (*Amer. Chem. J.*, 1896, **18**, 587—590; compare Abstr., 1895, i, 164).—Figures and curves are given illustrative of the action of nitric acid of diverse strengths (sp. gr. 1·05—1·40) on silver foil. Neither nitrogen nor nitrous oxide was produced in any of the experiments; nitric peroxide is the principal reduction product with concentrated acid, accounting for over 70 per cent. of the metal dissolved; the decrease of this gas and the complementary increase of nitric oxide as the acid is diluted is due to the decomposition of the nitric peroxide into nitric acid and nitric oxide by water. A. G. B.

Silver Peroxynitrate. By EDUARD MULDER and J. HERINGA (*Rec. Trav. Chim.*, 1896, **15**, 1—51).—The authors have investigated Ritter's black compound formed, under certain circumstances, in a silver voltameter when an aqueous solution of silver nitrate is electrolysed (compare also *Ann. Chim. Phys.*, 1880, [5], **21**, 174, and *Compt. rend.*, 1882, **94**, 573, and 653). The apparatus used consisted of a platinum reservoir of about 1 litre capacity, which served as the cathode, and which was nearly filled with a silver nitrate solution; the anode was formed of platinum wire, and placed just under it was a small glass vessel, which served to collect the black compound as it was formed. Two series of experiments were made, one series in which the solution was kept neutral by means of silver carbonate, and the other series in which the solution was not neutralised. Solutions of different strengths were used, the strongest contained 1000 grams silver nitrate in 1 litre of solution; weaker solutions were also tried, and experiments are being carried on with still weaker. Minute details as to the methods of analysis adopted are given; in most cases two or three different methods were tried. The black compound is liable to undergo spontaneous decomposition, oxygen being eliminated at the ordinary temperature and also on slightly warming; this oxygen the authors term the *oxygen excess.* Besides determining this oxygen excess, the authors have also estimated, in each case, the amount of silver nitrate and silver oxide, Ag_2O, contained in the black compound. The quantity of the compound deposited on the anode has also been determined, together with the amount of silver deposited on the cathode. The analysis of the black compound, obtained from very concentrated solutions, points to the composition $3Ag_2O,5O,AgNO_3$, perhaps $2Ag_3O_4,AgNO_3$, or $3Ag_2O_2,AgNO_5$.

There appears to exist a maximum of concentration with which a maximum of formation of the black compound coincides; the latter dissolves in nitric acid, yielding a brown solution. This accounts for the silver nitrate solution turning brown when electrolysed, as nitric acid is then set free. The compound is decomposed by water, but only very slowly, and the decomposition depends on the quantities and relationships of other substances present, for example, nitric acid, silver nitrate, &c. J. J. S.

Decomposition of Zinc Chloride by Water. By F. LOUIS PERROT (*Bull. Soc. Chim.*, 1895, **13**, 975—979).—The oxychloride of zinc, which is obtained on diluting a syrupy solution of zinc chloride with water, has been shown by André (*Ann. Chim. Phys.*, 1885, [6], **3**, 95) to have the composition $ZnCl_2,5ZnO,8H_2O$. The author finds that a precipitate is formed when pieces of pure anhydrous zinc chloride are dissolved in excess of water. This precipitate, when dried at 38° over sulphuric acid, has the composition

$$ZnCl_2,5ZnO,6H_2O.$$

The difference between the two compounds is, beyond doubt, due to the different methods of drying.

The author has followed this decomposition quantitatively by estimating the amount of oxychloride formed on dissolving the same quantity of zinc chloride in different quantities of water.

The point of equilibrium appears to be reached when 75 molecular proportions of water are used to each molecular proportion of zinc chloride. J. J. S.

Preparation of pure Zinc Sulphate from Crude Zinc Vitriol. By J. KNOBLOCH (*Chem. Centr.*, 1895, **11**, 435—436; from *Pharm. Zeit.*, **40**, 472—473).—The boiling zinc vitriol solution is treated with sufficient zinc fluoride to precipitate all the calcium and magnesium, but an excess should not be used, or if used should be removed by gypsum. Zinc oxide, mixed with water, is then added, the whole is left for a day, with occasional stirring, then filtered, acidified with a little sulphuric acid, and the filtrate evaporated till it begins to crystallise. If the crystals contain chlorine, it is necessary to recrystallise from water. J. J. S.

Cupric Sulphide. By JOHN B. COPPOCK (*Chem. News*, 1896, **73**, 262).—Copper sulphide precipitated in the presence of free acid is found to be contaminated with free sulphur; when, however, solution of copper sulphate in known excess is added to a solution containing a known quantity of hydrogen sulphide, the weight of precipitate obtained indicates the composition CuS; the existence of a sulphide of this composition has been disputed. D. A. L.

Colloïd Compounds of Rare Metals. By MARC DELAFONTAINE (*Chem. News*, 1896, **73**, 284).—When ammonia, in amount just sufficient to give a faint odour and turn blue litmus red, is added to a moderately strong solution of yttrium acetate, a slightly opalescent solution is obtained, which becomes turbid, but forms no precipitate; on boiling, however, it deposits a jelly, which redissolves on cooling, provided the boiling is not prolonged; when dialysed, ammonium acetate and part of the earthy acetate pass through the membrane. By leaving yttria many days in a clear solution of normal acetate and stirring frequently, the earth dissolves, and the same colloïd compound is obtained in a transparent, opaline, slightly fluorescent solution, depositing no sediment, having a strongly astringent, slightly sweetish taste, and turning red litmus blue. It is not very stable, especially after long dialysis; it coagulates on boiling, or even at about 60°, and when evaporated at the lowest possible temperature, it leaves a varnish that does not "integrally" redissolve in cold water; when calcined, it chars to some extent, owing to retention of acetic acid. Didymium, lanthanum, and erbium acetates give similar compounds, the didymium colloïdal solution being less stable than that of yttrium. D. A. L.

Action of Water, &c., on Aluminium. By EDUARD DONATH (*Chem. Centr.*, 1895, **ii**, 589; from *Zeits. angew. Chem.*, 1895, 141).—Hard aluminium foil is not attacked by boiled water which is free from air, whereas ordinary water acts on it appreciably. Calcium sulphate solution has no action, but solutions of chlorides, and especially of nitrates, dissolve the foil readily. Fats, fatty acids, and fused anhydrous phenol are all without action, but a 10 per cent. boiling solution of phenol forms yellow spots, and part of the aluminium goes into solution. The author attributes this more to the action of the air than to that of the phenol. J. J. S.

Chemistry of Iron. By EDUARD DONATH (*Chem. Centr.*, 1895, **i**, 1010—1011; from *Oesterr. Zeits. Berg-Hütt.*, **43**, 147—152).—The author has repeated Bourgeois and Schützenberger's experiments (this Journal, 1875, 788). He has treated large lumps of spiegeleisen with sodium-copper chloride solution, then with a ferric chloride solution previously acidified with hydrochloric acid, and finally with very dilute hydrochloric acid; a brown residue was obtained, which, on treatment with nitric acid, yielded nitrographitoic acid to which Bourgeois and Schützenberger have ascribed the formula $C_{22}H_{17}(NO_2)O_{11}$. It is readily soluble in water, yielding a deep black solution; the *ammonium* salt yields even deeper coloured solutions. The *barium* and *lead* salts have also been prepared; both are insoluble in water, and could not be obtained in a crystalline form.

The author has also repeated De Koninck's experiments (*Chem. Centr.*, 1891, i, 438), and has treated spiegeleisen with warm, dilute, sulphuric acid (1 : 5); he finds that a fatty organic residue remains, and that this dissolves in ether, yielding a deep yellow solution. It follows that, on treatment with acids, the combined carbon in iron yields, besides volatile products, non-volatile organic compounds, part of which are soluble in water and part in ether. This points to the conclusion that the carbon exists in iron in the form of different carbides of high molecular weight. J. J. S.

Molybdenite and the Preparation of Molybdenum. By M. GUICHARD (*Compt. rend.*, 1896, **122**, 1270—1272).—Molybdenite from Sweden was found to contain small quantities of iron and silica with traces of manganese and minute traces of selenium.

When heated in a carbon tube in the electric furnace with a current of 350 ampères and 60 volts, sulphur and sulphurous anhydride are given off. With 900—950 ampères and 50 to 55 volts, molybdenite fuses in two minutes, and decomposes with liberation of carbon bisulphide, sulphur, and a little selenious anhydride. After three minutes, decomposition is almost complete, and after five minutes the molybdenum is saturated with carbon, and the whole of the sulphur is expelled. The product contains about 91 per cent. of molybdenum, 2 per cent. of iron, and 7 per cent. of carbon. C. H. B.

Niobium. By Aksel Larsson (*Zeits. anorg. Chem.*, 1896, **12**, 188—207).—In order to obtain crystalline niobates, the author fuses the amorphous niobates with their respective chlorides, and also according to Ebelmen's method with boric acid in a porcelain furnace. The crystalline niobates obtained by the dry method are not attacked by cold or boiling dilute acids, and they are only decomposed by concentrated sulphuric acid at its boiling point. They are decomposed with difficulty by means of fused potassium hydrogen sulphate, and a complete decomposition is effected only at a red heat. They are partially decomposed by a mixture of hydrofluoric acid and sulphuric acid at the temperature of the water bath. The analysis is effected by decomposing the salts with potassium hydrogen sulphate. The melt is lixiviated with water, and the niobic acid separated by filtration, and washed with a dilute solution of ammonium nitrate or carbonate. The niobic acid is then ignited, and again fused with potassium hydrogen sulphate, this operation being repeated, if necessary, until the salt is completely decomposed. The niobic acid is finally heated over the blowpipe and weighed.

Magnesium niobate, $4MgO,Nb_2O_5$, is obtained by adding magnesium chloride to a solution of potassium niobate, and fusing the precipitate with anhydrous magnesium chloride. By lixiviating the melt with water and hydrochloric acid, the crystalline salt is obtained. It crystallises in tablets and prisms belonging to the hexagonal system: sp. gr. = 4·43.

Magnesium niobate, MgO,Nb_2O_5, is obtained by fusing the precipitated salt with boric acid, and lixiviating the melt with water. It forms small prismatic crystals, showing a stronger double refraction than calcium metaniobate.

Calcium niobate, $2CaO,Nb_2O_5$, is obtained by precipitating a solution of calcium niobate with calcium chloride, and fusing the precipitate with anhydrous calcium chloride. By lixiviating the melt with water, the salt is obtained in thick needles, mixed with slender needles of niobic acid.

Calcium niobate, CaO,Nb_2O_5, obtained by fusing the precipitated salt with boric acid and lixiviation with dilute hydrochloric acid, crystallises in needles and short prisms which probably belong to the rhombic system: sp. gr. = 4·12.

Copper niobate, CuO,Nb_2O_5, obtained by fusing the precipitated salt with boric acid and lixiviating with dilute hydrochloric acid, forms crystalline aggregates having lustrous faces: sp. gr. = 5·60.

Zinc niobate, ZnO,Nb_2O_5, sp. gr. = 5·69, forms brown crystalline aggregates which have a colour and lustre similar to zinc blende.

Cadmium niobate, CdO,Nb_2O_5, sp. gr. = 5·93, forms a yellowish-brown crystalline powder.

Cobalt niobate, CoO,Nb_2O_5, sp. gr. = 5·56, is obtained as a dark blue crystalline powder, having a faint double refraction.

Yttrium niobate, Y_2O_3,Nb_2O_5, sp. gr. = 5·52, is obtained by fusing the precipitated salt with yttrium chloride. *Yttrium niobate*,

$Y_2O_3,3Nb_2O_5$, sp. gr. = 4·83, is obtained by fusing the precipitated salt with boric acid. It crystallises in slender needles.

Manganese niobate, $3MnO,5Nb_2O_5$, sp. gr. = 4·97, is a dirty green crystalline powder consisting of prismatic needles and tablets.

Thorium niobate, $5ThO_2,16Nb_2O_5$, sp. gr. 5·21, is obtained by fusing the precipitated salt with boric acid. It crystallises in prismatic needles.

Zirconium niobate, $ZrO_2,5Nb_2O_5$, sp. gr. = 5·14, crystallises in slender truncated needles.

When lanthanum, barium, and strontium niobates, obtained by precipitating potassium niobate with the respective chlorides are melted with the anhydrous chlorides, niobic acid is obtained. A crystalline *lanthanum niobate*, containing 78·5—78·8 per cent. Nb_2O_5 and 18·5—20 per cent. La_2O_3, is obtained by fusing the precipitated salt with boric acid. The author has also obtained crystalline salts from precipitated nickel, beryllium, barium, strontium, and uranium niobates by fusing them with boric acid.

When niobic acid is heated with carbon in an electric arc, a metallic crystalline regulus is obtained. 0·1370 gram of this product, when heated in a current of oxygen, gave 0·1745 gram Nb_2O_5 and CO_2 = 0·0068 gram C. E. C. R.

Preparation of Sodium Thioantimonate (Schlippe's Salt). By Léon Prunier (*J. Pharm.*, 1896, [6], **3**, 289—290.—Purified antimony trisulphide is melted with a third of its weight of sulphur, and is thus converted into the pentasulphide; this is pulverised and introduced into a flask fitted with a cork and glass tube, and is then treated with a boiling solution of sodium sulphide (one part of crystalline sulphide to 15 of water). On cooling, the liquid is filtered, and the filtrate evaporated to a small bulk, when Schlippe's salt, $Sb_2S_5,3Na_2S + 18H_2O$, separates in the crystalline form.

J. J. S.

Chemistry of the Cyanide Process for dissolving Gold. By George A. Goyder (*Chem. News*, 1896, **73**, 272—273; compare this vol., ii, 28).—Hydrogen sulphide, or an alkaline sulphide, is found to interrupt the solvent action of potassium cyanide solution on gold, which, however, can be restored by means of mercuric oxide or chloride.

Experiments with portions of the same cyanide solutions, show that when exposed to zinc alone more gold is deposited than when exposed to both zinc and iron in contact, and, moreover, a loss of soluble cyanide occurs in the latter, but not in the former case.

With regard to the so-called "selective" action of dilute cyanide solutions for gold, it is pointed out that the dissolution of copper in potassium cyanide is a function of concentration, whilst the dissolving of gold in potassium cyanide depends on the proportion of oxygen present, which is a function of dilution, consequently more gold than copper is dissolved by the more dilute solutions; moreover, gold is dissolved by the double cyanides, and is apparently not precipitated except by the interaction of a free metal. D. A. L.

Double Salts of Ruthenium and Silver. By L. BRIZARD (*Bull. Soc. Chim.*, 1895, [3], **13**, 1092—1093).—The double chloride of nitroso-ruthenium and potassium, when treated with an ammoniacal solution of silver chloride, gives at once a rose-coloured crystalline precipitate of a compound, $RuNOCl_3,2AgCl,NH_3$. This compound is decomposed by water, giving a precipitate of silver chloride; it is sparing soluble in ammonia, readily in sodium thiosulphate or potassium cyanide solution. When heated it first melts, and then decomposes, yielding fumes of ammonium chloride. The corresponding *bromine* derivative, $RuNOBr_3,2AgBr,NH_3$, which may be prepared in a similar manner, forms clear, green crystals, and in its properties resembles the above compound. J. J. S.

Mineralogical Chemistry.

Classification of Minerals according to the Periodic System of the Elements. By E. SCHULZE (Marburg) (*Zeits. Kryst. Min.*, 1896, **26**, 189—191).—In a tabular arrangement with five classes, namely, elements, thiodids, haloïds, oxygen salts, and sulpho-salts, the groups are arranged according to the valency of the acid radicle. L. J. S.

Arsenic in Coal. By W. M. DOHERTY (*Chem. News*, 1896, **73**, 191—192).—Various New South Wales coals were examined for arsenic, but none was detected. Lead and copper were found in two instances. D. A. L.

Acanthite from Colorado. By ALBERT H. CHESTER (*Zeits. Kryst. Min.*, 1896, **26**, 526; from *School of Mines Quart.*, 1894, **15**, 103—104).—Acanthite occurs at the Enterprise mine, near Rico, as iron-black crystals of orthorhombic habit, and showing striated prisms with a basal plane or with acute terminations. The material is silver sulphide, with 12·58 per cent. of sulphur and traces of iron and copper. With the crystals is a massive silver sulphide, which is considered to be acanthite rather than argentite. L. J. S.

Pseudomorphs of Copper Oxides and Sulphides. By PAVEL V. VON JEREMÉEFF (*Zeits. Kryst. Min.*, 1896, **26**, 333—334; from *Verh. k. russ. min. Ges.*, 1894, **31**, 398—400).—The following pseudomorphs from various Russian localities are described. Kaolin (steinmark) after malachite. Tenorite after cuprite and chalcotrichite. Pyrrhotite after cuprite; here the cuprite has first been oxidised to tenorite, and this afterwards replaced by pyrrhotite. Copper pyrites after copper glance. Cuprite after malachite. L. J. S.

Pickeringite from the River Mana District. By WALDIMIR ALEXÉEFF (*Zeits. Kryst. Min.*, 1896, **26**, 336; from *Verh. k. russ. min. Ges.*, 1894, **31**, 350—351).—Besides the normal white mineral of this locality, a yellow variety of pickeringite is found, in which most of the alumina is replaced by ferric oxide, and the magnesia by ferrous oxide.

L. J. S.

Analyses of Samarskite, Pyrochlore, Tantalite, and Niobite [Columbite]. By K. von Chrustschoff (*Zeits. Kryst. Min.*, 1896, **26**, 335—336; from *Verh. k. russ. min. Ges.*, 1894, **31**, 415—417).—I. Samarskite from the Urals. II. Pyrochlore from the Urals.

	Ta_2O_5.	Nb_2O_5.	TiO_2.	SiO_2.	GeO_2.	SnO_2.	ZrO_2.	ThO_2.	UO_3.	WO_3.
I.	11·18	32·02	0·68	0·12	0·07	0·79	1·03	1·73	11·23	1·41
II.	—	56·01	8·32	—	trace	—	trace	4·28	—	—

	Ce_2O_3.	Di_2O_3.	La_2O_3.	Yt_2O_3.	Er_2O_3.	Fe_2O_3.	Al_2O_3.	FeO.	MnO.	CaO.
I.	0·25	1·56	0·37	7·83	13·37*	2·13	0·19	11·15	0·69	0·51
II.	2·16	1·94	1·23	0·56		—	—	2·52	—	14·05

	MgO.	PbO.	ZrO.	UO.	K_2O.	Na_2O.	H_2O.	F.	Total.	Sp. gr.
I.	0·41	0·15	0·17	—	0·21	0·28	1·22	—	100·77	5·899
II.	—	—	—	2·63	0·87	3·35	—	2·77	100·69	4·354

III. Tantalite from Finland. IV. Columbite from N. Carolina.

	Ta_2O_5.	Nb_2O_5.	TiO_2.	GeO_2.	SnO_2.	WO_3.	FeO.	MnO.	Total.	Sp. gr.
III.	23·97	49·56	0·77	0·02	2·17	0·96	9·86	11·98	99·29	6·211
IV.	68·15	11·15	trace	0·03	1·65	1·29	15·32	2·61	100·69	7·314

L. J. S.

Chemical Composition and Optical Characters of Russian Albite. By Sergei F. Glinka (*Zeits. Kryst. Min.*, 1896, **26**, 509—515; from *Verh. k. russ. min. Ges.*, 1894, **31**, 1—154).—Analyses and the optical constants (extinction and double refraction in plates cut in certain directions, and orientation of the acute bisectrix) are given of albite from various Russian localities. I. Crystals from Slatoust; sp. gr. 2·62 to 2·626. II. Crystals, enclosing rutile, from Kyschtym; here about 0·5 per cent. TiO_2 is included in the SiO_2 and Al_2O_3 in the analysis. III. From Kiräbinsk. IV. From the Melnikow mine, S. Urals. In these cases the calcium, &c., is considered to be present in enclosures, and from the observations the following optical constants are deduced for pure albite. Optic axial angle = 73—74°, $\gamma - \alpha = 0·01$, extinction on (001) = 3° 50′, extinction on (010) = 20° 30′, angle between a plane *s* perpendicular to the acute bisectrix and (001) = 79°, angle between the plane *s* and (010) = 14° 24′.

	SiO_2.	Al_2O_3.	Na_2O.	K_2O.	CaO.	MgO.	Total.	Sp. gr.
I.	68·47	19·64	11·12	trace	—	—	99·23	—
II.	68·04	20·01	11·09	0·80	0·42	0·12	100·48	2·623
III.	68·49	19·59	11·43	0·40	0·49	—	100·40	2·625
IV.	68·68	20·68	10·55	0·34	0·77	—	101·02	—
V.	66·73	19·87	10·29	0·25	1·22	0·50	98·86	2·623
VI.	66·12	20·88	9·37	0·97	1·89	—	99·23	2·624

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* 6 per cent. of Th. (6 per cent. of Tr. in the original).

V. Albite from Mursinka, this corresponding to *Ab* : *An* = 15 : 1; optic axial angle = 75° 30′, extinction on (001) = 2° 54′, extinction on (010) = 17° 18′—17° 30′. VI. Albite from Finland; here *Ab* : *An* = 10 : 1; extinction on (001) = 2° 30′, on (010) = 16°, the position of the acute bisectrix also varies somewhat from that of pure albite.

In these albites there is a connection between the optical characters, but not the crystallographic characters, and the chemical composition. The plagioclastic felspars are considered neither to form an isomorphous group nor to be double salts, but to be mixtures in various proportions of albite and anorthite, in which the optical characters and the specific gravity vary proportionately with the amounts of these constituents. L. J. S.

Glauconite. By Petr A. Zemjatschensky (*Zeits. Kryst. Min.*, 1896, **26**, 516—517; from *Travaux Soc. Naturalistes St. Petersbourg*, **23**, Sect. d. Géol. et d. Minér., 53—60).—By means of heavy solutions, the author has separated glauconite grains having different characters as regards sp. gr., colour (green to yellow-brown), and the size of the grains. Glauconite is completely decomposed by warm, 10 per cent. hydrochloric acid. On heating to 115°, there is a change in colour and lustre. Green grains, of 0·5—1 mm. diam., from Waywora, gave, on analysis, the results under I. Under the microscope, the material is sometimes seen as an aggregate of six-sided plates, and is distinctly dichroic. Sp. gr. 3·0400. At 100—110° there is a loss of 2·8268 per cent., at 200° of 1·554.

	SiO_2.	Fe_2O_3,Al_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	50·102	31·878	0·437	1·263	2·063	1·451	12·816	100·000
II.	45·751	34·461	0·642	trace	6·840	2·070	11·380	101·144

Dirty olive-green grains from Tschernowskoje (Gov. Nijni-Novgorod) gave analysis II; under pressure, the grains fall to yellowish-brown plates. At 100—115° there is a loss of 2·816 per cent., at 250—260° of 6·761. Dark green grains from Tagilj, of sp. gr. 2·8333, lost 3·1847 per cent. at 110°, and 3·8216 at 190—200°. In all the above cases the water was partially regained on exposing the material to the air at the ordinary temperature. L. J. S.

[**Andalusite or Dumorierite in Argentine Granite.**] By Paul Jannasch (*Zeits. anorg. Chem.*, 1896, **12**, 219—222). This mineral forms an amethyst powder, which sinters, but does not melt before the blowpipe, and becomes quite white when heated in a platinum crucible. Sp. gr. = 3·255 at 13·5°. Analysis gave

SiO_2.	B_2O_3.	TiO_2.	Al_2O_3.	Fe_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2O.
35·01	2·51	1·08	51·49	1·04	0·28	0·54	3·62	0·96	3·02

It also contains traces of lithium and organic matter. E. C. R.

Epidote and Zoisite. By Ernst Weinschenk (*Zeits. Kryst. Min.*, 1896, **26**, 156—177).—The composition of zoisite approaches to

$H_2Ca_4Al_6Si_6O_{26}$, and in epidote the molecule $H_2Ca_4Fe_6Si_6O_{26}$ is present in greater proportion, but in the author's klinozoisite there is actually less iron than in many zoisites. The similarity of the crystal angles of the two minerals is brought out by choosing the following parameters.

	a	: b :	c.
Zoisite....	2·9158 :	1 :	1·7900
Epidote...	2·8914 :	1 :	1·8057; $\beta = 81° 3'$.

Groth's view, that zoisite is derived by lamellar twinning from epidote, can be made to agree with the cleavage of the two minerals, but not with their optical properties; while Brögger's view of their morphotropic relationship agrees with neither.

The name *klinozoisite* is proposed for the monosymmetric members of the zoisite-epidote group, which, in their low content of iron, agree with zoisite in composition, and which are optically positive and have a lower index of refraction and double refraction than ordinary epidote. Analysis I is of rose-red klinozoisite from the Goslerwand in Prägraten, Tyrol, where it occurs with diopside and potash felspar in a metamorphic rock at a serpentine contact; sp. gr. 3·3720; optical constants under A, positive, $\rho < v$, $a : \mathfrak{c} = 2°$ in front; the crystal angles agree closely with those of ordinary epidote.

Epidote of a raspberry-red colour from Rothenkopf, Zillerthal, gave analysis II, the iron being here low for epidote; sp. gr. 3·3985; optical constants B.

Light green, columnar zoisite from the Gorner Glacier, near Zermatt, gave III (by A. Schwager), also trace of Cr_2O_3; sp. gr. 3·3720; optical constants C. Only the smallest crystals are optically uniform in character; others show irregularly bounded portions with optic axial angles of 90° and 50° in planes at right angles. Emerald-green zoisite from Kleinitz, near Prägraten, gave IV by Nagel, also Cr_2O_3 0·41; sp. gr. 3·3410.

	SiO_2.	Al_2O_3.	Fe_2O_3.	FeO.	MnO.	CaO.	MgO.	H_2O.	Total.
I.	39·06	32·57	1·68	0·29	trace	24·53	—	2·01	100·14
II.	38·60	31·71	3·52	0·35	trace	24·22	—	1·95	100·35
III.	39·31	32·48	2·78	—	—	23·07	0·22	2·54	100·40
IV.	39·42	33·23	1·07	—	—	24·25	—	2·11	100·49

	α.	β.	γ.	$\gamma - \alpha$.	$2V_{Na}$.
A........	1·7176	1·7195	1·7232	0·0056	81° 40′
B........	1·7238	1·7291	1·7343	0·0105	89 16
C........	1·6973	1·7002	1·7061	0·0088	—

The author considers epidote and zoisite to be dimorphous; klinozoisite in the epidote series having the same composition as zoisite. The variation of the optical constants with the amount of iron in epidote is pointed out (compare this vol., ii, 371). L. J. S.

Glaucophane from Beaume. By Luigi Colomba (*Zeits. Kryst. Min.*, 1896, **26**, 215; from *Atti Accad. Torino*, 1893-4, **29**, 404—423).

—Crystals of glaucophane from the schist and limestone at Beaume, an upper valley of the Dora Riparia, Piedmont, gave, on analysis

SiO_2.	Al_2O_3.	FeO.	CaO.	MgO.	Na_2O.	K_2O.	Total.
56·48	14·60	9·36	2·12	8·27	8·29	trace	99·11

Ferric oxide is present. The primary glaucophane is often altered to chlorite, felspar, and hæmatite. L. J. S.

The Occurrence of Ammoniacal Nitrogen in Ancient Igneous Rocks. By Hugo Erdmann (*Ber.*, 1896, **29**, 1710—1715). —The author has found that a number of minerals which occur in ancient igneous rocks evolve ammonia when they are warmed with pure aqueous soda, and has estimated the amount of nitrogen present by converting the ammonia thus evolved into ammonium platinochloride and weighing the latter. Thus a mineral resembling polycrase, which occurs in pegmatite near the lake of Ladoga, and which contains oxide of uranium, niobic acid, titanic acid, and certain of the rare earths, contains 0·028 per cent. of nitrogen evolved as ammonia, whilst another mineral from the same locality, which resembles euxenite, contains 0·005 per cent. of nitrogen. A large number of other minerals from the north of Europe, such as ytter spar from Hitteroe, euxenite from Arendal, fergusonite from Arendal, gadolinite and æschynite from Hitteroe also contain similar quantities of nitrogen. Many of these minerals also contain helium, and the author believes that the latter, like the nitrogen which accompanies it, is present in the form of a compound, and not simply occluded, as supposed by Tilden (*Proc. Roy. Soc.*, 1896, **59**, 218).

Ammonia can also be obtained from carnallite, being most probably derived from an extinct sea fauna. It is possible that the nitrogen of the ancient rocks played an important part in the nourishment of plants in the earlier geological periods. A. H.

Physiological Chemistry.

Composition of Human Fat. By Charles A. Mitchell (*Analyst*, 1896, **21**, 171—173).—The author has investigated the composition of human fat taken from the kidneys.

Excepting the refractive index or the Valenta test, most of the recognised tests were employed. The conclusion is, that the acids of human fat consist of 70 per cent. of liquid acids, principally oleic acid, and 30 per cent. of solid acids, probably palmitic, with small amounts of stearic and myristic acids and traces of lower fatty acids. L. de K.

Decomposition of Amygdalin in the Animal System. By Ernest Gérard (*J. Pharm.*, 1896, [6], **3**, 233—236).—The author has determined what digestive ferments react with amygdalin, and has also examined the action of the microbes of the stomach on the same compound. The thoroughly washed pancreas of a rabbit gave no hydrocyanic acid, and no product which reduced Fehling's solution when kept in an incubator for 80 hours at 36—37°, with 40 c.c. of thymolised water holding 0·4 gram of pure amygdalin in solution. A portion of the small intestine taken 75 cm. from the pylorus when treated in the same way gave reactions of hydrocyanic acid, but no reduction with Fehling's solution. Parts of the intestine near to the cæcum gave the same results. The organisms of the stomach bring about a similar decomposition. J. J. S.

Chemistry of Vegetable Physiology and Agriculture.

A new Oxydase or Soluble Oxidising Ferment of Vegetable Origin. By GABRIEL BERTRAND (*Compt. rend.*, 1896, **122**, 1215—1217).—The darkening of the juices of beetroot, dahlia, or potato tubers, *Russula nigricans*, &c., is due to the oxidation of the tyrosin under the influence of a soluble ferment. The constitution of tyrosin does not, however, satisfy the conditions of oxidisability through the medium of laccase (Abstr., 1895, i, 386, and this vol., i, 534), and experiment shows that it is not oxidised in presence of laccase. It follows that the phenomena observed must be due to some other ferment, to which the author gives the name *tyrosinase*. It is present not only in dahlia, beetroot, &c., but also in several fungi which contain no tyrosin, and can be extracted in the usual way, the best yield being obtained from certain fungi, and especially from some species of *Russula*. In the case of dahlia and beetroot, the ferment precipitated by alcohol shows but little activity. Direct experiment shows that laccase is without effect on various juices which oxidise readily in contact with tyrosinase, and that the extracts of *Russula*, &c., lose their fermenting power when heated at 100°.

The author gives the generic term *oxydase* to laccase, tyrosinase, and other oxidising ferments of vegetable origin.

Tyrosin can readily be obtained from dahlia roots by adding to the juice one-fourth of its volume of alcohol, filtering off the precipitated ferment as rapidly as possible, allowing the liquid to remain in well closed flasks until the residue is deposited, and then concentrating the mother liquor in a vacuum until the tyrosin crystallises.

C. H. B.

Assimilation of Nitrogen by Moulds. By KONSTANTIN A. PURIEWITSCH (*Chem. Centr.*, 1896, **1**, 125; from *Ber. deut. bot. Ges.*, **13**, 339—345).—*Aspergillus niger* and *Penicillium glaucum* did not grow in nutritive solutions (with cane sugar), free from combined nitrogen; ammonium nitrate was therefore added. Experiments, which lasted for two months, were made in 300—350 c.c. flasks containing 25 or 50 c.c. of nutritive solution. The flasks were sterilised, and the air which was passed through was absolutely free from nitrogen (*sic*). The results of the experiments showed assimilation of nitrogen, and growth of the mycelium, almost in proportion to the amount of sugar supplied. It is, however, concluded that the amount of nitrogen assimilated by moulds is independent of the amount of dry matter they contain. N. H. J. M.

Mineral Nutrition of Plants. By W. BENECKE (*Chem. Centr.*, 1895, **1**, 792—793; from *Bot. Gen. H.*, **12**, 105—117).—In experiments with *Aspergillus*, *Penicillium*, and *Triticum*, it was found that magnesium is essential for the growth of the fungi and cannot, as stated by Naegeli and Loew, be replaced by calcium, strontium, or barium, by beryllium, as stated by Sestini, or by zinc, or cadmium. In opposition to Naegeli, Loew, and Winogradsky, it was found that rubidium or caesium cannot be substituted for potassium. Similar results were obtained with *Triticum*, for which calcium is also essential as well as sulphur, phosphorus, potassium, magnesium, and iron. Elements with low atomic weights (lithium, beryllium) and with high atomic weights (rubidium, caesium, zinc, cadmium, strontium, and barium) are poisonous. Elements with intermediate atomic weights are indifferent or necessary. This is on the assumption of amounts of the elements to a given surface of the organism, equal to the amounts of magnesium and potassium which are favourable; in a very dilute state, strongly poisonous substances, such as zinc sulphate (Raulin) and copper (Tschirch, this vol., ii, 328) may promote growth. (Compare Sestini, Abstr., 1893, ii, 228). N. H. J. M.

Occurrence of Glutamine in Plants. By ERNST SCHULZE (*Ber.*, 1896, **29**, 1882—1884).—Glutamine can readily be separated from asparagine and tyrosine by crystallisation from water, whilst arginine can be removed by precipitation with phosphotungstic acid. It has been found in many plants, and appears to replace asparagine in many species of cruciferæ, in the ferns, and a few others. A. H.

Causes of Loss of Nitrogen in Decaying Organic Matter. By R. BURRI, E. HERFELDT and ALBERT STUTZER (*Chem. Centr.*, 1895, **1**, 501—502; from *J. Landw.*, 1894, **42**, 329—384; compare this vol., ii, 445).—In the preservation of stable manure the chief points are the control of the decomposition of urea and the absorption of ammonia. Loss of nitrogen in the free state will not take place as long as nitrification is suppressed, as for instance by compressing the manure and excluding air.

Bacteria which decompose urea ("ammonia bacteria") are generally present in stables and in all kinds of drainage, &c. Experiments made with the bacteria of liquid manure showed that urea was completely converted into volatile nitrogen compounds by them; they also converted about 22 per cent. of the nitrogen of peptone broth into volatile compounds, whilst pure cultures of "ammonia-bacteria" produced no ammonia from peptone broth. Urea was decomposed with great rapidity, uric acid less quickly, whilst hippuric acid was the least readily decomposed. But even the decomposition of hippuric acid is comparatively rapid when the length of time is considered during which manure is kept. The "ammonia bacteria" of liquid manure are not affected by strong solutions of ammonium carbonate; the amount of sulphuric acid necessary to destroy them is 0·4 per cent.

N. H. J. M.

Analytical Chemistry.

Apparatus for Gas Analysis. III. By Otto Bleier (*Ber.*, 1896, **29**, 1761—1762; compare this vol., ii, 70, 271).—A modification of the apparatus previously described. Close to the three-way tap a short capillary is fused, vertically upwards, it may either be closed with a rod, or connected with a stopcock when in use, this obviates the need of a three-way tap for each additional absorption pipette.

Carbonic oxide is absorbed in two vessels containing, respectively, cuprous chloride dissolved in ammonia, and hydrochloric acid.

A gas pipette for use instead of Hempel's double pipette is also described, it consists of a U-tube with a bulb near the extremity of each limb, the shorter of these is a capillary through which the gas is introduced and it carries a stop-cock at the junction of the capillary and bulb. The longer limb through which the bulbs are filled with the absorbent is closed by a rubber stopper between which and the bulb a short side-tube is fixed, attached to a caoutchouc balloon, which readily enables the capillary to be completely filled with liquid. This pipette is said to be cheaper than, and as efficient as Hempel's.

J. B. T.

Standardising Thiosulphate by Iodic acid. By E. Riegler (*Zeits. anal. Chem.*, 1896, **35**, 308).—On treating a solution of thiosulphate with one of iodic acid, the following reaction occurs, $6Na_2S_2O_3 + 6HIO_3 = 3Na_2S_4O_6 + 5NaIO_3 + NaI + 3H_2O$, and the smallest excess of iodic acid liberates iodine. Since iodic acid can be obtained absolutely pure, can be completely dried over sulphuric acid, is not hygroscopic, and remains unchanged for a long time when dissolved in water, a N/10 solution, made by dissolving 17·6 grams to a litre, is a very serviceable reagent for standardising thiosulphate.

M. J. S.

Volumetric Estimation of Soluble Iodides. By E. Riegler (*Zeits. anal. Chem.*, 1896, **35**, 305—307).—The following reaction occurs between iodic acid and an iodide; $6HIO_3 + 5NaI = 5NaIO_3 + 3H_2O + 6I$. By adding an excess of iodic acid, and titrating the excess by thiosulphate (see preceding abstract) after removal of the free iodine by light petroleum, the amount of iodide is ascertained. The solution of the iodide should not be stronger than 1 per cent. It is mixed with the iodic acid in a stoppered separator bulb, and shaken with two successive portions of light petroleum, after which starch is added and the excess of iodic acid titrated. M. J. S.

Separation of Ozone from Hydrogen Peroxide, and Recognition of Ozone in the Atmosphere. By CARL ENGLER and W. WILD (*Ber.*, 1896, **29**, 1940—1942).—It is found that hydrogen peroxide is immediately decomposed when its vapour is brought in contact with chromic acid, either in the solid state, or in concentrated solution; neither form of the oxidising agent, however, has any action on ozone, and it is possible by this means to completely deprive a mixture containing both substances, of the less stable constituent. The authors propose, therefore, to conduct air through glass beads and chromic acid, and test the gas with the ordinary ozone indicators. M. O. F.

Photometric Method for the Estimation of Lime and of Sulphuric acid. By J. I. D. HINDS (*Chem. News*, 1896, **73**, 285—287, 299—300).—By precipitating dilute solutions of sulphuric acid and calcium chloride with solid barium chloride and ammonium oxalate respectively, mixing by pouring from glass to glass, and then observing the length of column required to render the flame of an ordinary candle just invisible; it has been found that with solutions containing from 0·0246 to 0·0055 per cent. of sulphuric acid, and those derived from 0·0333 to 0·0067 per cent. of calcium carbonate, a regular relationship exists between the depth of the column and the quantity of precipitate in suspension, and, consequently, that the former can be taken as a measure of the latter. A constant source of light would be required, and the personal error ascertained before applying the method to practical purposes. The author has made use of the method in the analysis of waters and of urine. D. A. L.

New Method of converting Sulphates into Chlorides. By PAUL JANNASCH (*Zeits. anorg. Chem.*, 1896, **12**, 223—224).—The sulphates are fused with four to five times the quantity of boric anhydride, and heated in a platinum crucible until all the sulphuric acid is distilled off. The boric anhydride is then eliminated by means of alcoholic hydrogen chloride (this vol., ii, 576), or it may be treated directly with hydrogen chloride and methylic alcohol; 0·5 gram of sulphate, after 15—30 minutes' fusion, gave no reaction with barium chloride when dissolved in hydrochloric acid. E. C. R.

Action of Fused Polysulphides on Nitrogenous Organic Substances. By HEINRICH AUFSCHLÄGER (*Zeits. anal. Chem.*, 1896, **35**, 314—318).—Nitrogenous organic substances, fused with about 2 parts of potassium polysulphide (*hepar sulphuris*, prepared by fusing together 2 parts of potassium carbonate and 1 part of roll sulphur was used) yield considerable amounts of thiocyanate. Upwards of 50 substances belonging to the most widely varied classes were found to give this reaction, which is suggested as a general one for nitrogenous substances; it is obtained even with potassium nitrate, when this is fused with a mixture of potassium sulphide and ignited potassium tartrate. To test for the thiocyanate formed, the cooled melt is dissolved in water and freed from sulphides by zinc sulphate, with addition of some sodium hydroxide. Copper sulphate is then added to the filtrate. Since sulphites are present, no other reducing agent is required. The cuprous thiocyanate is filtered off, washed, and treated on the filter with ferric chloride. Some quantitative experiments with urea showed that about 10 per cent. of the theoretical yield was obtained. M. J. S.

Citrate-Soluble Phosphoric acid. By OTTO REITMAIR (*Zeit. angw. Chem.*, 1896, 189—194).—An exhaustive examination of the citrate-solubility question. Wagner's process being purely empirical, great care must be taken to prepare his ammonium citrate solution exactly according to his directions.

Gerlack's solution containing citric acid only, gives in many cases the same results as Wagner's; its use is also more convenient, as it always gives a clear-filtering solution. L. DE K.

Comparative Methods for estimating Citrate-Soluble Phosphoric acid in Basic Slags. By MAX PASSON (*Zeit. angw. Chem.*, 1896, 286—288).—Basic slags are now tested in Germany by simply estimating their citrate-soluble phosphoric acid; but complaint is being made of serious analytical differences.

The author has found that, when carefully following the conventional (Wagner's) directions, the amount of phosphoric acid dissolved by the ammonium-citrate solution is very constant. The analytical errors are, therefore, most likely caused during the further stages of the process. Excellent results are, however, obtained by the molybdate process if the temperature, during the precipitation, does not exceed 80—85°; if higher, there is a danger of silicic acid precipitating.

The accuracy of Wagner's process is shown by the result of 50 analyses of basic slag, each done in triplicate, using slightly different methods. L. DE K.

Source of Error as to the presence of, and Estimation of, Boric acid. By GORGES (*J. Pharm.*, 1896, [6], **3**, 346—347).—The author draws attention to the fact that the small quantity of boric acid, which is found in so many vegetable products on analysis, is probably introduced by some of the reagents used in the analysis, notably caustic soda and potash. Venable and Callison (*Chem. Zeit.*, 1890, **14**, 167) found 0·06 per cent. of boric acid in caustic potash and soda sold as pure; and the author has confirmed their results.

J. J. S.

Decomposition of Silicates by pure Hydrofluoric acid. By ALFRED H. ALLEN (*Analyst*, 1896, **21**, 87).—The author decomposes silicates in the following manner:—A mixture of commercial hydrofluoric acid with an equal bulk of sulphuric acid is placed in a large platinum crucible, and into this is placed a smaller crucible containing the silicate, moistened with a few drops of sulphuric acid. After covering the big crucible with a platinum dish filled with cold water, the arrangement is heated on an iron plate, when the acid volatilises, but again drops into the smaller crucible, and then decomposes the silicate. No fixed impurities are introduced into the latter, as is often the case when using commercial acid. L. DE K.

Decomposition of Silicates by Boric acid. By PAUL JANNASCH and O. HEIDENREICH (*Zeits. anorg. Chem.*, 1896, **12**, 208—218; compare this vol., ii, 219).—One gram of the finely powdered silicate is mixed in a platinum crucible with 3—6 times the quantity of dry powdered boric acid; in the case of fluorspar with eight times the quantity. The mixture is heated gently for 5—10 minutes, to drive off small quantities of water, then fused, and when it is in a state of quiet fusion, it is finally heated over the blowpipe. The fusion is usually finished in about 20—30 minutes. The red hot crucible is then placed on a porcelain triangle, and surrounded with cold water, in order to facilitate the removal of the fused contents. When cold, the fused mass is treated with water (100—150 c.c.) and concentrated hydrochloric acid (50 c.c.), and heated to boiling, when only a few flocks of silica should remain insoluble. The solution is then evaporated to dryness on the water bath; and when it commences to gelatinise is kept constantly stirred.

In order to separate the boric anhydride, the dried mass is treated with methyl alcoholic hydrogen chloride; the latter, which must be freshly prepared, is obtained by treating anhydrous methylic alcohol with dry hydrogen chloride, and then distilling off that portion of the product which comes over at 66—80°. The mixture is now warmed at 70—80° on the water bath, and, after two or three treatments with this liquid, is quite free from boric anhydride. The dry residual salt is heated at 110° for one hour, then lixiviated with hydrochloric acid and water, and the insoluble silica filtered off. The filtrate, which contains 0·5—2 per cent. of the silica, is again evaporated, and treated as above. The analysis of the residue is carried out by the usual methods.

The authors give the results of the analysis of several examples of silicates. E. C. R.

Behaviour of Minerals of the Andalusite Group towards Decomposing Agents. By PAUL JANNASCH (*Zeits. anorg. Chem.*, 1896, **12**, 219—222).—The decomposition of silicates by means of boric anhydride (see preceding abstract) is of general application, and simpler and more expeditious than the ordinary methods. Disthene, a mineral of the andalusite group, is, however, only partially decomposed by boric anhydride. Minerals of the andalusite group generally behave in an abnormal manner towards decomposing agents, as the author has already pointed out in the case of a mineral allied to andalusite or dumortiorite in Argentine granite. When heated with a mixture of calcium fluoride and hydrogen potassium sulphate on a platinum wire, it gives the green boron flame. The finely powdered mineral is only partially decomposed by a mixture of hydrofluoric and sulphuric acids. It can, however, be completely decomposed by ammonium fluoride. The ignited mineral is treated with ammonia, acidified with concentrated hydrofluoric acid evaporated to dryness, and fused for some time in a nickel crucible. The excess of ammonium fluoride is driven off at a higher temperature, and the remaining silicofluoride treated with dilute sulphuric acid. E. C. R.

Estimation of Potassium. By J. H. Vogel and H. Haefcke (*Landw. Versuchs-Stat.*, 1896, **47**, 97—255).—The shortened method for estimating potassium (*Fresenius Bd.*, **2**, 292) depends on the solubility of the platinochlorides of sodium, calcium, and magnesium, and the insolubility of potassium platinochloride in alcohol. The following average results were obtained by the author, and show the solubility of the potassium salt (at 17—19°) in alcohol of different strengths. Absolute alcohol, 1 : 35196 ; 95 per cent. alcohol, 1 : 31523 ; 80 per cent. alcohol, 1 : 20760. The results, which differ from Precht's (*Zeits. anal., Chem.*, **18**, 509), show that there is no danger of error when about 75 c.c. of absolute alcohol is used for washing, but repeated washing with hot alcohol seems hardly safe. Another weak point in the method is the weighing of the double salt on the filter, or (after redissolving) in a dish ; in drying on a filter there is a danger of partial decomposition of the salt, whilst when the double salt is redissolved in water and evaporated in a dish, large crystals are formed, which require prolonged heating at 130° before the weight becomes constant. These two objections are, however, overcome when the precipitate is collected and weighed in a perforated crucible, as at Halle.

With potassium solutions from which sulphates have been precipated by barium chloride, errors are readily introduced, owing to the excess of barium chloride forming a platinochloride during evaporation. This is only partly washed out by alcohol, being mostly decomposed thereby ; and the barium chloride formed, which is insoluble in alcohol, remains on the filter with the potassium double salt.

In the method now described (for potassium salts), the substance (10 grams) is dissolved in boiling water (300 c.c.), the volume of the solution being made up to 500 c.c. When cold, 50 c.c. of this solution (= 1 gram of salt) is evaporated nearly to dryness in a platinum dish, and, when cold, treated with 20 c.c. of neutral ammonium carbonate (Schaffgot's) solution, to precipitate the lime and magnesia. After about 12 hours the whole is filtered through a small filter, and washed with 10—15 c.c. of the ammonium carbonate solution. The filtrate is evaporated to dryness in a platinum dish, after adding a very little strong sulphuric acid, and finally heated to redness. The residue is dissolved in hot water, filtered into a porcelain dish, and treated with hydrogen platinum chloride and a drop of dilute hydrogen chloride. It is then evaporated until there is no longer an odour of hydrochloric acid. The cold residue is well rubbed with a mixture of absolute alcohol (2 parts) and ether (1 part), filtered, after 15 minutes, through a well-glazed porcelain Gooch crucible, and washed with some of the mixture. After being dried, the platinum salt is reduced in hydrogen. An apparatus for this purpose is described with sketch. It consists of a Kipp's hydrogen apparatus, to which a Finkener's washing apparatus is attached. The hydrogen passes directly into the crucibles through well fitting covers. The reduction takes place at 240—250°, and too high a temperature must be avoided. After 10—15 minutes, heating is discontinued, but hydrogen is passed through the crucibles until they are cold.

The contents of the crucibles are then extracted with hot water, after which the crucibles are ignited and weighed.

In estimating potash in organic substances, it is not advisable to burn off the organic matter, as there may be a loss of potash by volatilisation. Good results were obtained by decomposing with sulphuric acid, as in Kjeldahl nitrogen determinations. The solution is suitably diluted to a definite bulk, one portion being reserved for estimating nitrogen, another for potash. In estimating potash, the solution is treated first with ammonium carbonate solution, the process being continued, as already described. The ammonium sulphate must, however, be volatilised with great care, using a very small flame; three or four hours will be required for this.

Very exact results are obtained, even when the final amount of platinum is relatively small.

It is of the greatest importance to employ very pure hydrogen platinum chloride, and full directions are given for preparing it. The preparation of the ammonium carbonate solution and of the asbestos for the Gooch crucible are also described. With regard to employing Kjeldahl solutions, it is shown that no potash is dissolved from the glass by prolonged contact with sulphuric acid. N. H. J. M.

Microchemical Reactions [of Barium, &c., and Silver]. By HERMANN TRAUBE (*Zeits. Kryst. Min.*, 1896, **26**, 188—189).—Streng (Abstr., 1886, 487) has proposed to use tartar emetic as a reagent in testing for barium, but it is here pointed out that barium antimony tartrate is not to be distinguished from the strontium and lead salts; also at different temperatures differently hydrated and crystallised salts are obtained. Silver antimony tartrate is characteristic; and silver and lead are the only heavy metals which form crystallised salts. L. J. S.

Estimation of Zinc in Organic Salts. By GOTTFRIED VON RITTER (*Zeits. anal. Chem.*, 1896, **35**, 311—314).—The substance is moistened with concentrated nitric acid, the excess of acid evaporated at a low temperature, and the temperature gradually raised until the residue is burnt white, for which purpose the Lieben muffle is very suitable. Porcelain crucibles must be used, since platinum ones are attacked. M. J. S.

Double Compounds of Aniline and Metallic Salts. By J. L. C. SCHRÖDER VAN DER KOLK (*Zeits. anal. Chem.*, 1896, **35**, 297—305).—The crystalline precipitates obtained when many aqueous solutions of metallic salts are shaken with aniline or its aqueous solution can be employed for the micro-chemical detection of such metals. The author has determined the micro-crystallographic properties of aniline sulphate, nitrate and hydrochloride, of ferric and ferrous chlorides, of cobalt and nickel sulphates, nitrates and chlorides, and of the crystalline deposits obtained on treating solutions of these metallic salts with aniline, in the ordinary course of micro-chemical analysis. W. J. P.

Estimation of Tin. By CECIL J. BROOKS (*Chem. News*, 1896, **73**, 218—219).—Finding that stannous salts are more readily oxidised by bromine than by nitric acid, which only acts in strong solutions, and noting the volatility of stannic sulphide, the author recommends the following method for the estimation of tin. The solution is oxidised with bromine, and simultaneously treated with hot hydrogen sulphide solution, and also with the gas; the precipitate is filtered, washed, dissolved in hot ammonium sulphide, concentrated, oxidised with nitric acid, dried, ignited, and weighed. D. A. L.

Occurrence of Iodine in Waters. By MARCO T. LECCO (*Zeits. anal. Chem.*, 1896, **35**, 318—322).—The reaction with nitrous acid and carbon bisulphide is so sensitive that in waters containing no more than 0·1 milligram of iodine in a litre, it can be detected and colorimetrically estimated with sufficient exactness without previous concentration. In waters containing less than this amount, evaporation of a suitable volume to 100 c.c. and filtration before adding nitrite and sulphuric acid is the only preparation required.

By this means, iodine was detected in the mineral waters of Kurschumlija, Lomnitza, and Vrnjze, four springs of the baths of Koviljatscha, and three of the wells of the new Belgrade water supply. Of 12 other Belgrade well waters, which, as a rule, are rich in chlorine, iodine could be detected in only one. The proportion of iodine shows some degree of parallelism with the amount of iron in the waters. M. J. S.

Estimation of Dissolved Oxygen. By GYSBERT ROMIJN (*Rec. Trav. Chim.*, 1896, **15**, 76—80; compare Abstr., 1894, ii, 28).—The author describes a slightly modified form of the method previously given. Instead of using sodium hyposulphite as the reducing agent he employs a solution of manganese chloride (1 mol.) in water, to which Rochelle salt (2 mols.) and an excess of soda solution have been previously added. In the presence of dissolved oxygen the solution soon begins to turn brown, owing to the conversion of the manganous into a manganic salt, and if sufficient of the former be present, the whole of the dissolved oxygen will be used up in 10 minutes. The actual operation is carried out in a pipette, provided at either end with a single way glass stopcock, the upper cock carries a graduated cup, which contains exactly 1 c.c. to the mark. The pipette is filled with the water to be examined by Boot's method (Abstr., 1894, ii, 484). The water is removed from the graduated tube, and this is then filled to the mark with a solution containing 120 milligrams of manganese chloride and 85 milligrams of potassium iodide per c.c. This solution is introduced into the pipette, the tube is rinsed out, the pipette shaken, and then 1 c.c. of a solution of 10 grams Rochelle salt in 12 c.c. water is introduced in exactly the same way, and, finally, 1 c.c. of a solution of caustic soda containing 0·1 gram per c.c. After shaking, the mixture is allowed to remain for six minutes, 1 c.c. of a 25 per cent. hydrochloric acid is added, and the coloured liquid is introduced into a flask, and the free iodine titrated. J. J. S.

Analysis of Anthracene. By HENRY BASSETT (*Chem. News*, 1896, **73**, 178—179).—The sample is oxidised in the usual way, using 15 grams of chromic acid; the next day, it is diluted with 400 c.c. of water, and after three hours is filtered, washed with cold water, and dried in a water oven. The quinone is transferred to a flask with 45 c.c. glacial acetic acid, 2·5 c.c. of chromic acid solution containing 1·5 gram of the acid, and 10 c.c. of nitric acid, sp. gr. 1·420, and boiled for an hour in a reflux apparatus. The following day, it is diluted with 400 c.c. of water, and after three hours is filtered and washed successively with water, boiling 1 per cent. alkali, and hot water. The quinone is dried at 100°, heated for 10 minutes on a water bath with 10 times its weight of pure, concentrated, hot, not fuming, sulphuric acid, left during the night to absorb water in a covered tray of water, diluted, filtered, washed again with water, boiling alkali, and hot water, then dried, weighed, &c. (compare Abstr., 1895, ii, 332). D. A. L.

Estimation of Phenol in Soaps and Disinfectants. By HEINRICH FRESENIUS and C. J. S. MAKIN (*Zeits. anal. Chem.*, 1896, **35**, 325—334).—The phenol in dilute aqueous solutions can be distilled with quantitative completeness and estimated in the distillate by Tóth's modification of Koppeschaar's method (Abstr., 1877, i, 746; 1886, 744), which consists in the conversion of the phenol into tribromophenol by treatment with an excess of nascent bromine and titration of the unabsorbed bromine. The soap is dissolved in water, decomposed by a small excess of sulphuric acid, and the whole distilled with the help of a rapid current of steam, which considerably shortens the operation. Although traces of fatty acids pass over and consume bromine, their amount is so small that it may be neglected in practice. It, however, increases as the time of distillation is prolonged.

For disinfecting powders, which consist essentially of lime and carbolic acid, 0·5 gram is mixed with water in the distillation flask, and strongly acidified with hydrochloric acid before distilling.

The distillate is mixed in a stoppered flask with an excess of solution of sodium bromide and bromate. Hydrochloric acid is added, and the mixture shaken for 30 minutes. An excess of potassium iodide is then added, and, after 12 hours, the liberated iodine is titrated. Six atoms of bromine are consumed by one molecule of phenol. M. J. S.

Estimation of Pentoses and Pentosanes by the Furfuraldehyde Distillation Process. By BERNHARD TOLLENS (*Zeit. angw. Chem.*, 1896, 194—195).—The author (this vol., ii, 393) recommended distilling the substance with hydrochloric acid, and precipitating the furfuraldehyde with phloroglucinol.

For calculating furfuraldehyde to pentosanes in general, the factor 1·84 is now proposed. L. DE K.

Estimation of Sugars by Fehling's Solution. By JOHAN G. C. T. KJELDAHL (*Zeits. anal. Chem.*, 1896, **35**, 344—368; from *Meddelelser* *fra Carlsberg Laboratoriet*, **4**, 1).—The amount of cuprous oxide precipitated by identical quantities of sugar is largely influenced by the area of the surface of the liquid exposed to the air during the heating, as well as by the length of the boiling and the amount of copper solution employed. The following mode of procedure was, therefore, uniformly adopted. The requisite amount of Fehling's solution (usually 30 or 50 c.c., 15 c.c. being used only for very weak sugar solutions) was placed in a conical flask of 150 c.c. capacity. The measured quantity of sugar solution was added, and then water to exactly 100 c.c. The air was then excluded by passing hydrogen through the liquid until the end of the heating, and the flask was heated for exactly 20 minutes on the boiling water bath. The cuprous oxide was filtered off and weighed as usual, contact of air during this stage having far less influence than during the heating. The Fehling's solution was of the ordinary strength, but it is recommended that the three constituents should be kept apart until the time of use, when the solid tartrate should be dissolved in the soda solution. The exact proportions of tartrate and sodium hydroxide (65 grams per litre) must be adhered to.

The relation between the amount of copper reduced (Cu) and the sugar present (S) may now be expressed by the equation $Cu = aS - bS^2$, and the values of the factors a and b in the following table have been calculated from the experimental numbers by the method of least squares.

Volume of Fehling's solution.	Dextrose.		Levulose.		Galactose.		Arabinose.		Lactose, $C_{12}H_{22}O_{11} + H_2O$.		Maltose, $C_{12}H_{22}O_{11}$.	
	a.	$b \times 10^4$.	a.	$b \times 10^4$.	a.	$b \times 10^4$.	a.	$b \times 10^4$.	a.	$b \times 10^4$.	a.	$b \times 10^4$.
c.c.												
15	2·2810	70·162	1·9545	31·058	2·0089	46·851	2·2924	63·480	1·5031	16·922	1·3496	14·7850
30	2·3096	33·174	2·0654	22·750	2·0614	22·938	2·2506	25·192	1·5249	10·991	1·3143	6·9110
50	2·3300	20·490	2·1065	14·690	2·0937	14·626	2·2772	16·946	1·4296	4·1835	1·2322	3·0504
75	2·2786	12·333	2·0825	9·0112	2·0613	9·009	2·2695	11·615	1·3656	2·0120	—	—
100	2·2240	8·198	2·0658	6·3146	2·0087	5·871	2·1910	7·235	1·3340	1·3361	1·1305	1·0305

Extended tables for economising calculation are also furnished. When two sugars (for example, glucose and maltose) are present, the amount of copper they reduce jointly is expressed by the equation $p = \frac{px}{g} + \frac{py}{m}$, where p is the total amount of copper reduced, g the corresponding amount of glucose taken from the table, m the corresponding amount of maltose, x and y the respective amounts of glucose and maltose present. By making two determinations with different volumes of Fehling's solution, and using in the second case a multiple (n) of the amount of sugar used in the first, a second equation, $P = \frac{P}{G}nx + \frac{P}{M}ny$, can be obtained; whence

$$x = \frac{nm - M}{n\left(\frac{m}{g} - \frac{M}{G}\right)} \text{ and } y = \frac{ng - G}{n\left(\frac{g}{m} - \frac{G}{M}\right)}.$$

In opposition to E. Fischer (Abstr., 1895, i, 6), the author has confirmed by fresh experiments his original statement that maltose is not changed by yeast mixed with thymol. He cannot, however, confirm Jais' assertion that maltose is not attacked when heated with 70—100 parts of N/40 hydrochloric acid. M. J. S.

Estimation of Glucose. By HENRI E. CAUSSE (*J. Pharm.*, 1896, **3**, 433).—In consequence of the publication of Gerrard's method for the estimation of glucose (this vol., ii, 225), the author calls attention to the fact that he has already recommended a similar method (Abstr., 1889, 1036), employing potassium ferrocyanide instead of potassium cyanide. The author considers his own method the more delicate and trustworthy. J. J. S.

Examination of Honey. By ERNST BECKMANN (*Zeits. anal. Chem.*, 1896, **35**, 263—284).—The products of the action of acids on starch are the substances most generally employed in the adulteration of honey. Since in the manufacture of starch syrup the hydrolysis is carried on only to the point where iodine gives a red reaction, erythrodextrin and amylodextrin are commonly present, and may be precipitated from the adulterated honey by the addition of methylic alcohol to its concentrated aqueous solution. Both dextrorotatory (flower) and lævorotatory (conifer) honeys are almost entirely soluble in methylic alcohol. Honey containing starch syrup is coloured red to violet by iodine solution, whereas pure honey gives no such colour. If the hydrolysis of the starch has been carried so far that iodine no longer gives any coloration, as in the manufacture of solid starch sugar, no precipitate is produced by methylic alcohol. Such starch sugar, however, still contains dextrinoïd substances, which yield barium compounds insoluble in methylic alcohol, whilst the dextrins of natural honey give no precipitate, or, in the most unfavourable case, that of conifer honey, only about 2·5 per cent. For qualitative testing, 5 c.c. of a solution containing 20 grams of honey in 100 c.c. is shaken in a test tube with 2 c.c. of a 2 per cent. baryta solution and 17 c.c. of methylic alcohol, a comparative experiment with a pure honey, of about the same dextrin content, being advisable in doubtful cases. For quantitative estimation, the baryta precipitate should be collected on a Gooch filter, washed first with 10 c.c. of methylic alcohol, then with 10 c.c. of ether, and dried at 55—60°. The more rapidly the whole operation is performed the better. The results obtained with specially prepared mixtures of conifer honey with starch syrup and sugar show that the fact of adulteration can in all cases be detected, although they do not suffice for the calculation of its amount. In doubtful cases, a combination of the fermentation process, using a feebly acting yeast (beer yeast, or yeast of the Saatz type), by which the dextrins of natural honey are more completely fermented than those of starch products, may be resorted to.

The addition of molasses to honey is best detected by examining for raffinose with basic lead acetate (1 part of lead acetate, 3 parts of litharge, and 10 parts of water) and methylic alcohol. The honey solution should not be stronger than 25 per cent., and for 5 c.c. of the solution 2·5 grams of basic lead acetate and 22·5 c.c. of methylic alcohol are employed. Conifer honey gives 1 per cent., molasses 50—70 per cent., of lead precipitate. M. J. S.

Detection of Formalin. By HENRY DROOP RICHMOND and L. KIDGELL BOSELEY (*Analyst*, 1896, **21**, 92—94).—The authors recommend Hehner's test as being the most delicate test for formylaldehyde in milk; far more sensitive even than their own test with diphenylamine (Abstr., 1895, ii, 426).

The test is best applied by first diluting the sample with an equal bulk of water, and then carefully adding sulphuric acid of 90—95 per cent. strength. If formylaldehyde is present, a violet ring is formed where the two liquids meet. L. DE K.

Detection of Formalin. By OTTO HEHNER (*Analyst*, 1896, **21**, 94—97).—The author finds that the blue colour developed when milk containing formylaldehyde is mixed with sulphuric acid is due to the presence of the caseïn.

To test wine or vinegar for this preservative, a drop of milk is added to the sample, and the mixture is poured carefully on to sulphuric acid contained in a test tube. A blue ring will then form if formylaldehyde is present. L. DE K.

Estimation of Formaldehyde. By HARRY M. SMITH (*Analyst*, 1896, **21**, 148—150).—The sample is mixed with aqueous potash until the amount of alkali is about 10 per cent. Solution of potassium permanganate, 5·26 grams per litre, is now slowly run in until the green colour disappears rather slowly, and the liquid is then heated to 30° to cause the precipitate to subside. More permanganate is then added until an olive-green colour is obtained permanent for 15—20 seconds. At this stage, when the aldehyde has been converted into formic acid, 1 c.c. of the permanganate = 0·0015 gram of formaldehyde.

As a check, the mixture may now be boiled, and the adding of permanganate be continued until an emerald-green colour is obtained, lasting at least 10 minutes. At this stage, the formic acid now being completely converted into carbonic acid, 1 c.c. of the permanganate = 0·0075 of formaldehyde. L. DE K.

Estimation of Tartar and Tartaric acid in Wine. By B. HAAS (*Zeits. anal. Chem.*, 1896, **35**, 376; from *Zeits. Nahrungsmittel-Unters. und Hygiene*, **2**, 97).—In each of two porcelain basins is placed 50 c.c. of the wine, the acidity of which has previously been ascertained, and to one of these portions is added enough potassium carbonate solution to neutralise exactly half the free acid present. Both liquids are now evaporated to 3—5 c.c., adding to the half neutralised one 2 c.c. of glacial acetic acid for each gram of tartaric acid neutralised. 100 c.c. of 95 per cent. alcohol is gradually, and with stirring, added to each residue. After two hours, the precipitates are collected on a filter, washed with 95 per cent. alcohol, and then titrated with potash in hot aqueous solution, using litmus tincture as indicator. The unneutralised portion gives the tartar, and the difference between the two the tartaric acid. M. J. S.

Composition and Analysis of Commercial Cream of Tartar. By ALFRED H. ALLEN (*Analyst*, 1896, **21**, 174—180, 209).—The author, after criticising the B.P. tests for cream of tartar, finally proposes the following process. 1·881 gram (or in important cases double this quantity) of the *dried* sample is dissolved in hot water and titrated with N/10 alkali and phenolphthaleïn. In absence of other acid substances, 1 c.c. of the alkali represents 1 per cent. of potassium hydrogen tartrate. The same amount is ignited, but without attempting to burn off the carbon. The mass is boiled with water, and the filtrate is titrated with N/10 hydrochloric acid and methyl-orange. When dealing with a pure sample, the number of c.c. of acid will correspond exactly with the c.c. of alkali used in the first experiment, but each c.c. of deficiency represents 0·36 per cent. of calcium sulphate, or 0·72 per cent. of potassium hydrogen sulphate. Any excess points to the presence of potassium tartrate, each c.c. representing 0·60 of this compound. The sulphate may be, of course, estimated by means of barium chloride.

The insoluble matter is ignited to burn off the carbon, and the ash is dissolved in 20 c.c. of N/10 acid, any insoluble residue, such as sand, or barium sulphate being filtered off, and the liquid titrated with N/10 alkali and methyl-orange. Each c.c. corresponds with 0·5 per cent. of calcium tartrate or 0·3 per cent. of calcium sulphate.

L. DE K.

Titration of Quinine. By ALFRED H. ALLEN (*Analyst*, 1896, **21**, 85—87).—The author points out that commercial quinine sulphate is neutral towards brazil wood, logwood, and cochineal, distinctly alkaline to litmus, and strongly so to methyl-orange.

When titrating with the last indicator, double the amount of standard acid will be required. L. DE K.

A New Reaction for Antipyrine or for Quinine. By C. CARREZ (*J. Pharm.*, 1896, [6], **3**, 253—255).—When a mixture of equal parts of antipyrine and quinine is treated with bromine water and then with ammonia, a red coloration is obtained which is given by neither of the alkaloïds separately. This red compound, *quinerythropyrine*, is best extracted from its ammoniacal solution by means of chloroform. It is only slightly soluble in pure water, but readily in acidified water. With acids, it gives an orange-rose colour, and with alkalis a violet-rose. The reaction can be made use of in testing for quinine or for antipyrine, and is also applicable for urine testing.

J. J. S.

General and Physical Chemistry.

Spectrum of Phosphorus in Fused Salts and certain Metallurgical Products. By ARNAUD DE GRAMONT (*Compt. rend.*, 1896, **122**, 1534—1536).—When fused phosphates are subjected to the action of a condensed spark (next abstract), a line spectrum of phosphorus is obtained superior to that seen in a Plücker's tube. With sodium or potassium phosphate, the following lines are observed, and are bright and distinct except where otherwise indicated: 6506 (diffuse), 6458, 6088, 6042, 6034·5, 6025, 5498·5, 5462 (feeble), 5453 (feeble), 5423·5, 5409, 5385, 5340, 5311, 5292, 5250, 4968 (diffuse), 4941, 4603, 4588·5. The lines most easily recognised are the triplet, 6042-6034·5-6025, in the red, and the doublet, 4603-4588·5, in the blue. This spectrum is seen in many metallurgical products containing phosphorus—and especially in copper phosphides when these are examined in the manner previously described (Abstr., 1895, ii, 470). The brightness of the lines diminishes with the proportion of phosphorus, and the characteristic triplet in the red becomes invisible in metals when the percentage falls to between 1·0 and 0·1 of phosphorus. C. H. B.

Dissociation Spectra of Fused Salts of Alkali Metals. By ARNAUD DE GRAMONT (*Compt. rend.*, 1896, **122**, 1411—1413).—Salts of alkali metals offer special advantages in the study of the line spectra of the non-metals by the action of a highly condensed spark on the fused salt, because of the comparative simplicity of the spectrum of the metal. In the case of these salts, the spectrum with a highly condensed spark differs considerably from that obtained with the spark and the metal itself, or with the fused salt and a non-condensed spark. The carbonates, although dissociated with difficulty, give the spectra of the metals in their simplest form, and no lines of carbon are observed. Fluorides also show relatively little tendency to dissociate, but other salts, such as chlorides, bromides, and iodides, decompose readily.

Sodium salts show the three intense doublets—6160-6154, 5895-5889, 5687-5682, whilst all other lines are feeble, though 5675, 5669, 5155, 5152, and a broad diffuse band, 4983-4978, are recognisable.

Potassium salts show 7698, 7665, 6939, 6911, 6308, 6245·5, 6117·5, 5832, 5811, 5801, 5783, 5360, 5344, 5340, 5323, 5113, 5099, 4828, 4389, 4309, 4264, 4223, 4185, 4045, although the first two are difficult to see.

Lithium salts show 6706, 6103, 4972, 4603, 4273, 4132, and the small number of lines shown by this metal makes its salts particularly suitable for investigations of the spectra of the non-metals.

C. H. B.

"Convection" Currents. By FRANZ RICHARZ and CARL LONNES (*Zeit. physikal. Chem.*, 1896, **20**, 145—158).—The authors endeavoured to determine the cause of the currents through acidified water, which occur with electromotive forces insufficient for the decomposition of the water. As hydrogen peroxide is produced with a stronger E.M.F., they considered it probable that a similar formation might also be the cause of the convection currents. Preliminary experiments showed that the peroxide is not produced when the platinum and gold electrodes employed are placed in acidified water, although they contained occluded hydrogen. During the passage of the convection currents, however, hydrogen peroxide is formed, but the quantity produced is insufficient to account for the current, neither is it in any way proportional to the current strength as measured by a silver voltameter. The peroxide is not produced with an E.M.F. below that of one Daniell's cell. Experiments with solutions of sodium hydroxide showed that sodium peroxide is formed at the cathode, but no barium peroxide is produced in solutions of barium hydroxide. L. M. J.

Electromotive Force and Partition Equilibrium. By ALFRED H. BUCHERER (*Zeit. physikal. Chem.*, 1896, **20**, 328—330).—The author claims to have made several of the observations recorded by Luther (this vol., ii, 461), and to have drawn similar conclusions at an earlier date, his results having appeared in the *Electrochem. Zeit.* for January, and in the *Chemiker Zeitung* of January 4th.

L. M. J.

The Potential Differences at the Surface of Contact of Dilute Solutions. By OLIN FREEMAN TOWER (*Zeit. physikal. Chem.*, 1896, **20**, 198—206).—By calculating the potential difference between $HNO_3(1)—HNO_3(2)$ by means of Nernst's formula, and subtracting this from the E.M.F. of the galvanic chain $MnO_2—HNO_3(1)—HNO_3(2)—MnO_2$, the sum of the potential differences between the acids and electrodes can be obtained. Also, by means of approximations in Planck's formula, the potential differences, $HNO_3(1)—KCl$ and $KCl—HNO_3(2)$, can be ascertained, and, by adding these to the previous results, the E.M.F. of the chain $MnO_2—HNO_3(1)—KCl—HNO_3(2)—MnO_2$ can be calculated. This was done with chains in which not only potassium chloride but also sodium chloride and sodium nitrate at concentration 1 to 1/128 normal were employed, and in all cases there was satisfactory agreement between the calculated numbers and the observed E.M.F. In all cases the presence of the salt solution diminished the negative potential difference between the acids, and so increased the E.M.F. of the cell; this effect increasing with the concentration of the salt. In the case of similar experiments with zinc electrodes in solutions of zinc nitrate, the agreement was not so satisfactory, possibly owing to Planck's formula being available only for univalent ions, for which the previous experiments prove its validity. L. M. J.

Electrolytic Decomposition of Fused Zinc Chloride. By RICHARD LORENZ (*Zeit. anorg. Chem.*, 1896, **12**, 272—276).—A determination of the voltage required to decompose pure fused zinc chloride gives the number 1·49 to 1·50 volts. Three different strengths of current were employed in the experiments, and the results obtained from each agree closely. The theoretical voltage = 2·1, but it must be remembered that the temperature at which the experiments were carried out was 500—600°. E. C. R.

Influence of Ethylic Alcohol on the Electrolytic Dissociation of Water. By RICHARD LÖWENHERZ (*Zeit. physikal. Chem.*, 1896, **20**, 283—302).—The author has re-determined the electrolytic dissociation of water by Ostwald's method (Abstr., 1893, ii, 365), using, also, a correction for the difference of potential between acid and base as indicated by Nernst (Abstr., 1894, ii, 343).

The apparatus employed was similar to that described by Smale (Abstr., 1894, ii, 436). Owing to the variations, the values for the E.M.F. could not be considered accurate to the extent of more than 1/1000 volt. Solutions of acid and alkali of N/10 and N/100 were employed, and the values for the dissociation thus obtained were 1·075 × 10^{-7}, 1·187 × 10^{-7}, and 1·134 × 10^{-7}, numbers agreeing well with the results of Wijs, Arrhenius and Shields, and Kohlrausch; on the addition of ethylic alcohol, however, the dissociation was found to decrease, the following values being obtained.

7·4 p. c.	— 0·92 × 10^{-7}.	86·6 p. c.	— 0·0574 × 10^{-7}.
24·0 „	— 0·69 × 10^{-7}.	92·6 „	— 0·0270 × 10^{-7}.
41·8 „	— 0·470 × 10^{-7}.	97·4 „	— 0·0096 × 10^{-7}.
64·8 „	— 0·201 × 10^{-7}.	99·8 „	— 0·00288 × 10^{-7}.

The results indicate that in solutions of little water in much alcohol, the water obeys the law of feebly dissociated electrolytes, that is, the concentration of the ions is proportional to the square root of the water concentration. In stronger solutions, however, the dissociation is greater than indicated by the law, and the water is shown to have a stronger dissociating influence on its own molecules than the ethylic alcohol has. L. M. J.

New Method of determining Freezing Points. By MEJER WILDERMANN (*Proc. Roy. Soc.*, 1896, **59**, 251—254).—The author discusses the best means of determining freezing points in dilute as well as in concentrated, solutions. The proper arrangement of equilibrium in the heterogeneous system is first mathematically considered, and the proper treatment of the instrument used for measuring temperature is explained. H. C.

Freezing Point Depressions in very Dilute Solutions. By RICHARD ABEGG (*Zeit. physikal. Chem.*, 1896, **20**, 207—233).—The freezing points of a number of solutions were determined, a full account of the apparatus and method being given in the paper. The preliminary experiments indicated the necessity of maintaining a constant rate of stirring, as variations caused a marked difference in the Newtonian constant k of the equation $dt = k(t_0 - t)/dz$ (where t_0 = convergence temperature, Abstr., 1895, ii, 155). Experiments with potassium chloride and cane sugar further show that the value of k is not constant for different solutions, so that the conclusions of

Wildermann (this vol., ii, 291) are not valid. The value of t_0 was in all cases only slightly lower ($<0·5°$) than the actual freezing point of the solution, so that the error due to this difference, which was found to be about 2 per cent. per degree, cannot exceed 1 per cent., and the results are therefore not further corrected. Several series of experiments were performed with very dilute solutions of each compound, and the mean of each series taken. The values for the molecular depression thus obtained are: cane sugar, 1·89, 1·82, 1·89, 1·845; alcohol, 1·78, 1·79; urea, 1·86, 1·875; dextrose, 1·78, 1·84; tartaric acid, 1·83, 1·84. In the case of electrolytes (potassium chloride, sodium chloride, and potassium sulphate) the dissociation was calculated with the value 1·85 for the molecular depression, and the results obtained are compared with those derived from the conductivity. The agreement is satisfactory, but the cryoscopic values are generally the higher. L. M. J.

Ethylic Salts of the Chloracetic acids. By PAUL RIVALS (*Compt. rend.*, 1896, **122**, 1489—1491).—*Ethylic Chloracetate.*—Heat of combustion (1 gram) +4029·1 Cal.; molecular heat of combustion at constant volume +493·56 Cal., at constant pressure +493·85 Cal.; heat of formation of the liquid from its elements, +129·75 Cal.

$C_2H_3O_2Et$ liq. + Cl_2 = $C_2H_2ClO_2Et$ liq. + HCl gas .... develops + 35·6 Cal.

Ethylic Dichloracetate.—Heat of combustion (1 gram) +2951 Cal.; molecular heat of combustion at constant volume and at constant pressure, +463·31 Cal.; heat of formation of the liquid from its elements, +130·7 Cal.

$C_2H_3O_2Et$ liq. + $2Cl_2$ = $C_2HCl_2O_2Et$ + 2HCl .... develops +28·75 × 2 Cal.

Ethylic Trichloracetate.—The heat of formation of this compound was determined indirectly by the action of trichloracetic chloride on ethylic alcohol.

$C_2Cl_3O_2H$ sol. + EtOH liq. = $C_2Cl_3O_2Et$ liq. + H_2O liq. .... develops +2·0 Cal.

From the data already given it follows that

$C_2H_2ClO_2H$ liq. + EtOH liq. = $C_2H_2ClO_2Et$ liq. + H_2O liq. .... develops +3·0 Cal.

The substitution of chlorine for hydrogen in acetic acid increases the energy of the acid function, and the chloracetic acids in this respect resemble formic acid and the more energetic organic acids (compare Abstr., 1895, ii, 254). C. H. B.

Acetal and Monochloracetal. By PAUL RIVALS (*Compt. rend.*, 1896, **122**, 1488—1489).—*Acetal.*—Heat of combustion (1 gram), +7802 Cal.; molecular heat of combustion at constant volume, +920·7 Cal. at constant pressure, +923·2 Cal.; heat of formation of the liquid from its elements, +125·6 Cal.

Chloracetal.—Heat of combustion (1 gram), +5825 Cal.; molecular heat of combustion at constant volume, +888·31 Cal., at constant pressure, +889·70 Cal.; heat of formation of the liquid from its elements +129·7 Cal.

From these and previous results (compare Abstr., 1895, ii, 306) it follows that

C_2H_4O liq. + Cl_2 = C_2H_3ClO liq. + HCl gas .... develops +28·3 Cal.
$C_6H_{14}O_2$ liq. + Cl_2 = $C_6H_{13}ClO_2$ liq. + HCl gas .... „ +26·1 „

and hence the heat of formation of chloracetal from monochloraldehyde and alcohol (−4·0 Cal.) is practically equal to the heat of formation of acetal from aldehyde (−2·3 Cal.). In other words the substitution of chlorine for hydrogen in aldehyde has no appreciable influence on the heat of formation of the ethylic derivatives of aldehyde. C. H. B.

Heat of Vaporisation of Formic acid. By DOROTHY MARSHALL (*Compt. rend.*, 1896, **122**, 1333—1335).—The heat of vaporisation of carefully purified formic acid was determined by the method of comparison (this vol., ii, 349), the other liquid being benzene. The value obtained is 120·36, which agrees with that obtained by Favre and Silbermann, 120·7. The quotient of the molecular heat of vaporisation by the absolute temperature ML/T, is 14·7, which is identical with the corresponding number for acetic acid.

The value of the latent heat of vaporisation of formic acid, calculated by Raoult's formula, from his observations on its vapour tension, is 120·9. C. H. B.

Heat of Dissolution of Sodium Chloride. By ED. VON STACKELBERG (*Zeit. physikal. Chem.*, 1896, **20**, 159—167).—From the experimental data of Winkelmann and Staub, tables are derived and curves constructed for (1) the heat of dissolution of sodium chloride at various concentrations; (2) the total heat of dissolution up to these concentrations, at temperatures 18° and 0°. The curves (1) cut the concentration 35·5 per cent. ordinate at about +1·2 Cals. and −4 Cals., so that at 0° the heat of dissolution in a concentrated solution is negative, but positive at 18°, results which agree with the observations of Braun and Deventer. The curves, moreover, cut at about 20 per cent., so that it follows that the temperature coefficient of the heat of dissolution is negative in dilute solutions, but becomes positive at higher concentrations, a result which is also shown to obtain with solution of sodium nitrate, potassium nitrate, potassium chloride, and ammonium chloride. Corresponding with the change from the positive to the negative value in curve (1), the curve for the total heat of dissolution at 0° reaches a maximum at about 25 per cent., after which it decreases. L. M. J.

Thermochemistry of Uranium Compounds. By J. ALOY (*Compt. rend.*, 1896, **122**, 1541—1543).—*Heats of Dissolution at*

18—20°.—Uranium nitrate, $UO_2(NO_3)_2 + 3H_2O$, −3·7 Cal.; sulphate, $UO_2SO_4 + 3H_2O$, +5·1 Cal.; chloride, $UO_2Cl_2 + H_2O$, +6·05 Cal.; chromate, $UO_2CrO_4 + 5\frac{1}{2}H_2O$, −6·3 Cal.; acetate, $UO_2(C_2H_3O_2)_2 + 2H_2O$, −4·3 Cal.; uranyl potassium chloride, $UO_2Cl_2,2KCl + 2H_2O$, + 2·0 Cal.; uranyl ammonium acetate, $UO_2(C_2H_3O_2)_2 + NH_4 \cdot C_2H_3O_2 + 6H_2O$, −3·8 Cal.

Uranyl hydroxide, $UO_2(OH)_2$, was prepared by evaporating a solution of the nitrate in absolute alcohol (Malaguti), and by heating the nitrate on a sand bath (Berzelius). Both products had the same composition, and gave the same thermal disturbances when dissolved in acids. The heats of neutralisation with two equivalents of various acids at 19°, were as follows: Hydrochloric, +8·4 Cal.; hydrobromic, +8·8 Cal.; nitric, +8·4 Cal.; sulphuric, +9·5 Cal.; acetic, +7·5 Cal.

The heats of formation of the uranyl salts from the hydroxide are lower than those of zinc and lead salts, and approximate to those of the ferric and chromic salts. C. H. B.

Measurement of the Heat of Formation of Triethylic Phosphate by the Action of Phosphorus Oxychloride on Sodium Ethoxide. By J. Cavalier (*Compt. rend.*, 1896, **122**, 1486—1488).—When phosphorus oxychloride is added to a solution of sodium in excess of dry alcohol, there is an immediate energetic action with formation of sodium chloride and triethylic phosphate. The following measurements were made.

Heat of dissolution of sodium in alcohol (Na + 12EtOH)		+42·88 Cal.
$POCl_3$ liq. + 3EtONa diss. = Et_3PO_4 diss. + 3NaCl pptd.	develops	+109·77 „
Heat of dissolution of triethylic phosphate in alcohol		−0·20 „

From these results, it follows that

$POCl_3$ liq. + 3Na sol. + 3EtOH liq. =
Et_3PO_4 liq. + 3NaCl sol. + 3H gas.. develops +238·59 Cal.

and combining this result with the known data involved,

H_3PO_4 cryst. + 3EtOH = Et_3PO_4 liq. +
$3H_2O$ liq. develops −9·4 Cal.

a result comparable with that obtained in the case of alcohol and acetic acid. C. H. B.

Diffusion of Metals. By William Chandler Roberts-Austen (*Phil. Trans.*, 1896, **187**, 383—415. "Bakerian Lecture").—Very little attention has been given hitherto to the consideration of the molecular movements which enable two or more molten metals to mix spontaneously and form a truly homogeneous fluid mass. Some experiments on the mobility of gold and silver in molten lead, made by the author about 14 years ago and communicated to the Chemical Section of the British Association in 1883, appear to be the first ever made with the direct object of investigating the diffusion of molten metals and alloys, other than those of mercury which are liquid at the ordinary temperature. The research has been resumed during the past two years, and the diffusion of various metals in molten lead, bismuth, and tin has been carefully investigated.

The tubes which contain the molten metal are arranged in an air bath with double walls, which can be readily maintained at definite temperatures, the measurement of the temperature being effected by the aid of thermo-junctions. The tubes are carefully kept hotter at the top than at the bottom, so as to avoid convection currents from the bottom of the tube. At the end of a given period, varying from six hours to seven days, the diffusion tubes were removed, cooled from below, carefully measured, and then cut into transverse numbered sections, the metallic contents of each section being weighed and analysed.

According to Fick, who applied Fourier's theory of thermal conduction to the phenomena of material diffusion generally, the movement in linear diffusion may be expressed by the differential equation—

$$dv/dt = k(d^2v/dx^2).$$

In this equation, x represents the distance in the direction in which the diffusion takes place; v is the degree of concentration of the diffusing metal, and t the time; k is the diffusion constant, that is the number which expresses the quantity of the metal, in grams, diffusing through unit area (1 sq. cm.) in unit time (one day), when unit difference of concentration (in grams per c.c.) is maintained between the two sides of a layer 1 cm. thick. The unit of diffusivity has the dimensions $[L^2T^{-1}]$, so that diffusion constants may be expressed in square centimetres per day. The constant has a definite value for each pair of metals (that is for the diffusing metal and its solvent) at a particular temperature, and the object of the experiments on diffusion is to determine this value. It was found that the tables calculated by Stefan for the diffusion of salts apply in the present instance. By the help of these tables, the diffusion constant could be determined when the distribution of the dissolved diffusing metal was known.

In the following table, the results of the more recent experiments are recorded.

It will be seen that gold diffuses more rapidly in bismuth and in tin than it does in the heavier metal lead. It has also been observed that platinum diffuses faster in bismuth than in lead. The diffusion of platinum and of gold is increased in about equal ratio by the substitution of bismuth for lead as a solvent. On the other hand, platinum diffuses much more slowly in lead than gold does, although their atomic weights and their densities do not greatly differ. Rhodium, another metal of the platinum group, diffuses in lead nearly as fast as gold does; but if allowance be made for the smaller atomic weight, it will be found to agree fairly well with platinum. This would point to the conclusion that the platinum metals are molecularly more complex than either gold or silver, as a complex molecule exerts less osmotic pressure and diffuses more slowly than a comparatively simple one.

Diffusing metal.	Solvent.	Temperature.	*k* in square centimetres.	
			Per diem.	Per second.
Gold	Lead	492°	3·00	$3·47 \times 10^{-5}$
„	„	492	3·07	3·55 „
Platinum	„	492	1·69	1·96 „
„	„	492	1·69	1·96 „
Gold	„	555	3·19	3·69 „
„	Bismuth	555	4·52	5·23 „
„	Tin	555	4·65	5·38 „
Silver	„	555	4·14	4·79 „
Lead	„	555	3·18	3·68 „
Gold	Lead	550	3·185	3·69 „
Rhodium	„	550	3·035	3·51 „

The diffusion of metals is not increased nearly so rapidly by a rise in temperature of 50° as the ordinary aqueous diffusion of salts is. It may be that the molecules of the diffusing substance are not so liable to disruption by a rise in temperature.

A number of experiments were made on the diffusion, at ordinary temperature, of gold in mercury, the value found for *k* at 11° being 0·72 sq. cm. per day. From experiments by Guthrie (1883) on the diffusion of zinc, tin, lead, sodium, and potassium in mercury, the following values for *k*, in square centimetres per day, were calculated.

Tin in mercury at about 15°	1·22
Lead „ „	1·0
Zinc „ „	1·0
Sodium „ „	0·45
Potassium in mercury at about 15°	0·40

The experiments described in the first part of this paper naturally suggested the inquiry whether gold would still permeate lead if the temperature were maintained at a point far below the melting point of lead. The attempt was first made to ascertain whether diffusion of gold in solid lead could be measured at 250°, that is 75° below the melting point of lead. Thin plates of gold were fused on to the end of cylindrical rods of lead, 14 mm. in diameter and 7 cm. long. Such cylinders were maintained at 250° for 31 days in a little iron chamber lined with asbestos. They were then measured and cut up into sections, and the amount of precious metal in the respective sections was determined by analysis. In each case gold was found throughout the entire length of the cylinder, and the diffusivity was found in one case to be 0·023 and in another 0·03 sq. cm. per diem.

Similar results were obtained in experiments at 200°, which lasted only 10 days, the diffusivity found being 0·007 and 0·008.

As the above experiments were conducted at temperatures above the melting point of the eutectic alloy of gold and lead (200°), care was taken to ascertain whether gold would diffuse in solid lead well below this point, and for this purpose the temperature chosen was 165°. The diffusivity could still be determined, and was ascertained to be 0·005 and 0·004 sq. cm. per diem in two experiments. Even at 100° the diffusion of gold in solid lead can still be determined, the diffusivity being about 0·00002, or only 1/100,000th of that which occurs in liquid lead.

Experiments were made on the diffusion of gold in solid silver at 800°, this being 160° below the melting point of silver, and 50° below that of the eutectic alloy of gold and silver. The temperature was intermittent, so that the true diffusivity could not be taken, but the diffusivity is of the same order as that of gold in lead at 200°. It would appear, therefore, that the melting points of the metals have a dominating influence on the resistance offered to diffusion.

H. C.

Relation between Osmotic Pressure and the Law of Active Masses. By ALEXANDR A. JAKOWKIN (*Zeit. physikal. Chem.*, 1896, **20**, 321—327).—Starting with Nernst's law that the active mass of a solvent is at constant temperature proportional to its vapour pressure (Abstr., 1893, ii, 367), the equation $x(a - 1 + x) = kv(1 + x)$ leads to $c/C\left(a - \frac{C - c}{C}\right) = kv(C - c)/C$, where C is the vapour pressure of the solvent and c that of the solution. From this, by neglecting the coefficient c/C, which is nearly equal to unity, the equation $PV(1 + kv) = RT$ is derived for the osmotic pressure. It is hence not exactly equal to the gas pressure, but as kv is generally very small, it is approximately so. L. M. J.

The Course of Chemical Reactions in Gases. By ERNST COHEN (*Zeit. physikal. Chem.*, 1896, **20**, 303—306).—Storch, in a paper on this subject (this vol., ii, 296), came to the conclusion that the reaction for the formation of water from the mixed gases is not a trimolecular reaction, but one of the 9th order, obtaining a constant value for k in the equation $dc/dt = kc^9$. The author does not consider that the results justify the conclusion owing to the enormous influence of the walls of the containing vessels on the reaction velocities of gases. In the decomposition of arsenic trihydride, a constant k is not obtained until the walls of the vessel become completely covered with arsenic. During the long heating in Storch's experiments, the author considers that the velocity constant would certainly alter, so that the fact that the equation of the 9th order leads to a constant value indicates that the reaction itself cannot be of this order.

L. M. J.

The Influence of Pressure on Reaction Velocities. By VICTOR ROTHMUND (*Zeit. physikal. Chem.*, 1896, **20**, 168—179).—The experiments of Röntgen showed that at high pressures the velocity of inversion of cane sugar is diminished, a result which he ascribed to a decrease in the dissociation of the acid. This conclusion was, however, contested by Tammann (Abstr., 1894, ii, 410). Moreover, high pressures were proved by Fanjung (Abstr., 1894, ii, 438) to cause an increase in the conductivity, although the number of ions is only very slightly altered. The author has, therefore, re-examined the effect of pressure on the velocity of inversion of cane sugar, and obtained results in complete agreement with those of Röntgen (*Ann. Phys. Chem.*, 1892, **45**, 98), the velocity decreasing by about 1 per cent. per 100 atmospheres. In order to see whether this effect is really due to a change in the number of ions, the effect of pressure on the velocity of hydrolysis of methylic and ethylic acetates was determined, hydrochloric acid of the same strength as before being employed. In this case, however, the velocity was found to *increase* to the extent of about 3·7 per cent. per 100 atmospheres. The velocity was found to be equally well represented by a linear or exponential formula, and no change was obtained when the concentration of the acid was altered, or by the use of nitric acid. From this, the author concludes that the effects cannot be due to alterations in the dissociation. If the presence of "active" and "inactive" molecules be assumed, of which only the former can undergo decomposition, the results may be explained by the effect of pressure on the equilibrium between the active and inactive molecules (Abstr., 1889, 1103). L. M. J.

New Relations between the Atomic Weights of the Elements. By M. Carey Lea (*Zeit. anorg. Chem.*, 1896, **12**, 249—252).—In a previous paper on the colour of atoms, ions, and molecules (Abstr., 1895, ii, 441) cerium was classed with the eleven elements whose ions are in some cases coloured, in others colourless. The author now classes cerium amongst the elements having coloured ions: the ion of the ceri-compounds is without doubt coloured; the ion of the cero-compounds appeared to be colourless, but these compounds have a faint red colour. Gold was placed in the former paper amongst the series which gives only coloured ions; there is some doubt, however, with regard to the auro-compounds. The oxides and haloïds are coloured, but are insoluble, and therefore the colour of the ions cannot be determined. Aurous chloride, however, dissolves in sodium chloride and yields colourless salts, and other aurous double salts are colourless, and yield colourless solutions. The soluble aurous salts appear to be colourless, and the author, therefore, places gold amongst those elements yielding both coloured and colourless ions.

If the difference between the atomic weights of each two elements as arranged in the author's series be taken, it is found that in the first series the difference is very near to the number 16; then follow 20 elements with a difference which begins at 41·3 and gradually increases to 49. The differences between the remaining elements is 88, with the exception of that between iridium and thallium, whose atomic weights are not yet satisfactorily determined. E. C. R.

Inorganic Chemistry.

The Density of Hydrogen. By Edward W. Morley (*Zeit. physikal. Chem.*, 1896, **20**, 242—271).—Five series of determinations of the density of hydrogen were made. In the first series, the gas was weighed in large calibrated flasks, and the pressure and temperature taken by a barometric manometer and mercury thermometer. In the second series, the volume was measured at the temperature of melting ice, and the pressure measured by a siphon barometer. The details of these methods are practically the same as those in the case of the oxygen determinations (Abstr., 1895, ii, 261; this vol., ii, 518). The hydrogen was obtained by electrolysis, and the utmost pains taken to ensure its purity; in those cases where analysis showed nitrogen to have been present (maximum, 0·0045 per cent.) the density was corrected for this. The results of the 15 experiments of the first series varied between D = 0·089993 and 0·089846 (grams/litre) with the mean value 0·089938 ± 0·000007. The results of 19 determinations of the 2nd series varied between 0·090144 and 0·089869 with a mean value 0·089970 ± 0·000011. In the third, fourth, and fifth series, a tube containing 600 grams of palladium charged with hydrogen was placed in communication with three exhausted calibrated flasks of a total capacity of 42 litres, kept in melting ice. The weight of the hydrogen was obtained by the loss in weight of the palladium tube, and the pressure of the gas, read by a siphon barometer; by this method, the weighing of the hydrogen is effected with greater accuracy than when it was made in the measuring flasks themselves, and the author considers this method to be far preferable to the former. Full details of the apparatus and the manipulation are given in the paper. The results of these last three series are—

	No.	Mean value.	Difference of extremes.
3rd	8 determinations	0·089886 ± 0·0000049	0·000040
4th	6 ,,	0·089880 ± 0·0000080	0·000070
5th	11 ,,	0·089866 ± 0·0000034	0·000044

The final mean of the results is given as D = 0·089873 ± 0·0000027.

L. M. J.

Helium, a Gaseous Constituent of certain Minerals. Part II. Density. By William Ramsay (*Proc. Roy. Soc.*, 1896, **59**, 325—330; see Abstr., 1895, ii, 498). The gas obtained from clèveite contains some, but not much, nitrogen, and no hydrogen. Samples of gas from bröggerite, samarskite, and fergusonite, obtained by heating the mineral in a vacuum, are rich in hydrogen; the amount of nitrogen is in all cases infinitesimal. The yield from these sources is very variable; for whereas 1 gram of clèveite yielded 7·2 c.c. of helium, 1 gram of bröggerite yielded somewhat less than 1 c.c. of helium; the yield from samarskite was about 0·6 c.c. per gram; and from fergusonite 1·1 c.c. per gram, the last by heating alone; with the other minerals, the residue, after heating, was fused with hydrogen potassium sulphate. The gas obtained from fergusonite, on heating, was found on analysis to have the following percentage composition:—Hydrogen, 54·7; carbonic anhydride, 13·9; helium, 31·2. No hydrocarbons were present, and the residue gave a spectrum free from nitrogen flutings, even when the pressure was comparatively high.

Density determinations were made with gas purified by treatment with caustic soda, and circulation over red-hot copper oxide, soda-lime, and phosphoric anhydride. The bulb used had the capacity 162·843 c.c., and the possible error in the results may amount to 0·014. The following numbers were obtained.

		Means.
Mixture of gas from bröggerite and clèveite ..	2·218	—
Same mixture, recirculated	2·133	—
The last sample is probably the purer.		
Bröggerite gas; fresh sample	2·181	2·181
Samarskite; heat alone	2·121	2·118
Samarskite; fusion with $HKSO_4$............	2·122	
Samarskite; gas again circulated............	2·117	
Samarskite; after further circulation	2·114	
Fergusonite; heat alone.....................	2·147	2·140
Fergusonite; another sample	2·139	
Fergusonite; another sample	2·134	

These numbers furnish some ground for the supposition that the helium from various sources is not quite homogeneous, but that different samples differ slightly in density. They point to a possible division into groups. The gas from bröggerite appears to have the density 2·18, that from samarskite 2·12, and that from fergusonite 2·14. The gas from clèveite is possibly still lighter.

The light emitted from a vacuum tube containing clèveite gas has a richer orange-yellow shade than is shown by gas from bröggerite, samarskite, or fergusonite. The clèveite gas shows, in addition to the usual strong lines, a set of fairly strong lines between the very strong green and the strong blue. These lines have never been observed in samples of gas from bröggerite, samarskite, or fergusonite.

H. C.

New Gas obtained from Uraninite. By JOHN NORMAN LOCKYER (*Proc. Roy. Soc.*, 1896, **59**, 342—343).—Runge and Paschen, as the result of diffusion experiments on the gas from clèveite, came to the conclusion that the gas giving the line D_3 was heavier than the gas giving the line 5015·7, but the result was not final, as the pressures were not the same. It is important for stellar classification to settle this matter, and the author has therefore made experiments in which the pressures remained the same. These clearly indicate that if a true diffusion of one constituent takes place, the component which gives D_3 is lighter than the one which gives the line at wave-length 5015·7. This conclusion is entirely in harmony with the solar and stellar results. H. C.

Gases obtained from the Mineral Eliasite. By JOHN NORMAN LOCKYER (*Proc. Roy. Soc.*, 1895, **59**, 1—3).—Observations have been made on the gases obtained from the mineral eliasite when heated in a vacuum; in addition to lines of known gases, others have been noted, for which no origins can be traced. Many of these are probably coincident with lines in stellar and solar spectra, but there are others with which no celestial coincidences have been traced. It is important to note that all these lines do not appear in the spectrum at the same time. In the first two portions of the mineral no trace of D_3 was noted, but in the third portion examined, all coming from the same specimen, D_3 appeared as a pretty bright line. In one experiment, the products of distillation, collected in four stages, gave different spectra. The lines observed in eliasite indicate a new gas, in some way associated with those given off by clèveite and bröggerite, and the fact that D_3 is not necessarily present in the spectrum, furnishes an additional argument in favour of the view that the gas obtained from clèveite or bröggerite is complex. H. C.

New Gases obtained from Uraninite. By JOHN NORMAN LOCKYER (*Proc. Roy. Soc.*, 1895, **59**, 4—8; compare Abstr., 1895, ii, 430 and 470).—The author in this paper brings together the notes which he has previously made on the spectra of the new mineral gases. Besides the hydrogen lines, all three chromospheric lines in Young's list which have a frequency of 100 have now been recorded in the spectra of the new gas or gases obtained from minerals by the distillation method. Determinations of the wave-lengths of many other lines in the spectra of the new gases have been made, and the results leave little doubt as to the coincidence of several lines with those appearing in the chromosphere, nebulæ, and white stars. It seems very probable also that many lines which have been noted, and for which no origins have yet been traced, belong to gases which have not hitherto been recorded in the chromosphere. A table is given which summarises the chief lines which have so far been recorded in the new gases from various minerals. H. C.

Expansion of Argon and of Helium as compared with that of Air and Hydrogen. By J. P. KUENEN and WYATT W. RANDALL (*Proc. Roy. Soc.*, 1896, **59**, 60—65).—The authors have compared the readings shown by thermometers containing respectively argon, helium, hydrogen, and air, at the temperatures of the melting point of ice and the boiling points of water, chlorobenzene, aniline, quinoline, and bromonaphthalene. The helium used was of density 2·13 (O = 16), and the argon, which was prepared from atmospheric air by the magnesium method, had the density 19·99.

The results of the observations are given in the table. In three cases (3, 4, and 6) the reading was taken at 0°, as well as at the boiling point of water, so that the coefficient of expansion could be calculated between these two points. The higher temperatures determined have been derived from the observed pressures by using the coefficients thus measured; with the hydrogen thermometer, 0·003663 was taken as the coefficient of the gas.

Thermometer.	Corrected pressure, 0°.	In steam at about 100°	Coefficient of expansion, 0—100°.	Temperatures calculated.			
				Chlorobenzene.	Aniline.	Quinoline.	Bromonaphthalene.
1. Hydrogen.	—	712·56	—	131·6	183·9	236·35	—
2. Air I	—	737·74	—	131·8	183·6	[234·9]	281·65
3. Helium...	567·02	775·18	0·003665	132·2	184·1	236·9	[278·3]
4. Argon I ..	517·02	706·06	0·003668	132·15	184·1	—	—
5. Argon II .	529·54	—	—	—	—	237·8	281·5
6. Air II....	511·68	698·79	0·003663	—	—	237·1	—

Although the authors do not claim any remarkable accuracy for these results, they serve to show that the behaviour of argon and helium, as far as expansion is concerned, and within the limits of temperature used, is the same as that of so-called perfect gases or mixtures of them. H. C.

Some Physical Properties of Argon and Helium. By LORD RAYLEIGH (*Proc. Roy. Soc.*, 1896, **59**, 198—208).—The density of argon prepared by the aid of magnesium was found by Ramsay (this vol., ii, 99) to have a mean value of 19·941 (O = 16). To further test the identity of the gases, the author has determined the density of argon prepared by Cavendish's oxygen method; large scale weighings of pure argon with the globe of 1800 c.c. capacity employed in former weighings of gases, being undertaken. A series of weighings was obtained with intermediate sparkings, so as to obtain evidence that the purification had really reached a limit. The density thus determined was found to be 19·940, and the conclusion from the spectroscopic evidence that the gases, isolated from the atmosphere by magnesium and by oxygen, are essentially the same, is confirmed.

The refractivity of argon was determined in the hope that it might throw some light on the character of the gas. As absolute measurements were not required, it sufficed to compare the pressures necessary in two columns of air and argon of equal lengths, in order to balance the retardations undergone by light in traversing them. The ratio of the refractivity of argon to that of air was thus found to be 0·961, so that the evidence from the refractivities is very unfavourable to the view that argon is an allotropic form of nitrogen such as would be denoted by N_3.

Similar comparisons were made between air and helium. The observations were not made under ideal conditions, on account of the smallness of the changes of air pressure; but, with considerable approximation, the refractivity of helium to that of air is 0·146. The lowest refractivity previously known is that of hydrogen, nearly 0·5 of that of air.

The viscosity of argon and helium was investigated by the method of passage through capillary tubes. If the driving pressure $(p_1 - p_2)$ is not too great, the volume V_2 delivered in time t through a tube of radius R and length λ is given by

$$V_2 = \pi t \frac{p_1^2 - p_2^2}{2p_2} \frac{R^4}{8\eta\lambda},$$

the volume being measured at the lower pressure p_2, and η denoting the viscosity of the gas. The results referred to dry air were, for helium, 0·96, and for argon, 1·21, somewhat higher than for oxygen, which at present stands at the head of the list of the principal gases.

Examination of the gas from the Bath springs showed that this gas contains appreciable quantities of helium in addition to the argon already proved to be present. The gas from the Buxton springs contains about 2 per cent. by volume of argon, but the presence of helium could not be confirmed.

The question of the presence of helium in the atmosphere is, apart from its independent interest, of importance in connection with the density of atmospheric argon. Since the spectrum of this gas does not show the line D_3, we may probably conclude that the proportion of helium is less than 3 per cent.; so that there would be less than 3×10^{-4} of helium in the atmosphere. Ramsay has shown that the solubility of helium in water is less than one-fifth that of argon, so that if a mixture of helium and argon be dissolved in water until there is only a small fraction remaining over, the proportion of helium will be much increased in the residue. 60 c.c. of argon was therefore treated with boiled water until the volume was reduced to 1·5 c.c. The gas still gave no sign of the D_3 line, and if helium is present in the atmosphere, it must be in very small quantity, probably much less than a ten-thousandth part.

H. C.

Acids containing Sulphur and Nitrogen. By MAX WAGNER (*Zeit. physikal. Chem.*, 1896, **20**, 334).—The author regrets having, in his previous paper on acids containing sulphur and nitrogen (this vol., i, 470), omitted reference to the work of Hantzsch (this vol., ii, 95, 96) and of Divers (*Ber.*, **28**, 996; **27**, 567. See Trans., 1895, 452, 1095, 1098).

L. M. J.

Nitrosodisulphonic acid. By PAUL SABATIER (*Compt. rend.*, 1896, **122**, 1479—1482 and 1537—1539).—The absorption spectrum of the blue-violet solution formed by a nitrite and cuprous oxide in presence of sulphuric acid (this vol., ii, 622) is quite different from the spectra of the ammonio-cupric compounds or the purple cupric hydrobromide, but is similar to that of the deep blue-violet solution of the potassium nitrosodisulphonate described by Fremy and by Raschig.

In many cases when nitric acid or nitrogen oxides are dissolved in sulphuric acid containing sulphurous anhydride, and the solution is exposed to moist air, there are indications of the formation of a dark blue compound. If a mixture corresponding with 2NO + O is passed into sulphuric acid saturated with sulphurous anhydride and cooled at 0°, the liquid remains colourless, but, on adding water very slowly, a dark blue product is formed. When a mixture of air and nitric oxide is passed into sulphuric acid of the composition $H_2SO_4 + H_2O$, saturated with sulphurous anhydride and cooled at 0°, the blue-violet compound is formed at once, with vigorous effervescence. With somewhat stronger acid, the liquid is at first colourless, but the blue-violet substance forms gradually. The reaction takes place in two stages, $2NO + O + 2SO_2 + H_2O = 2NO{\cdot}SO_3H$ and $2NO{\cdot}SO_3H = NO + NO(SO_3H)_2$. Nitrosodisulphonic acid decomposes spontaneously into sulphuric acid, sulphurous anhydride, and nitric oxide, but is much more stable than the potassium salt described by Fremy, and does not decompose rapidly even at 100°.

When agitated with air or mixed with hydrogen peroxide, persulphuric acid, nitric acid, chlorine, or potassium chlorate, it is rapidly decolorised. Potassium perchlorate and bromine act more slowly. Alkali chlorides are immediately decomposed with evolution of hydrogen chloride and chlorine; potassium iodide at once decolorises the liquid, and iodine is liberated. Sulphurous acid is without action; water at once decomposes the blue compound.

Most metallic oxides and carbonates decompose the solution of nitrosodisulphonic acid, and are converted into sulphates. Ferric oxide, however, gives a wine-red solution, and the same compound is formed by placing metallic iron or a concentrated solution of ferrous chloride or sulphate, or some particles of ferrous oxalate into the acid. Ferric salts do not give this coloration.

Cupric carbonate, oxide, or hydroxide, metallic copper, or any cuprous salt yields an intense blue-violet coloration (*loc. cit.*). With copper or cuprous salts, nitric oxide is liberated. Chromic hydroxide also yields a very deep blue-violet solution, but chromium and chromous salts have no action.

In all these cases, the colour of the solutions of the salts is very much more intense than that of the acid, and the solutions themselves are more stable. C. H. B.

Action of Silicon on Metals. By Emile Vigouroux (*Compt. rend.*, 1896, **123**, 115—118; compare Moissan, this vol., ii, 173).—As regards their action with silicon, the metals may be divided into two classes.

I. Those which do not combine directly with silicon, even in the electric furnace. Examples: alkali metals, zinc, aluminium, lead, tin, antimony, bismuth, gold, and silver. These all dissolve silicon to some extent, but deposit it again, in a crystalline form, on cooling.

II. Those which combine directly with silicon to form crystalline silicides. Examples: iron, chromium, nickel, cobalt, manganese, copper and platinum.

Platinum silicide, $SiPt_2$, is a white, extremely hard, brittle solid, its sp. gr. at 18° is 13·8, it is capable of dissolving silicon, and is attacked, when hot, by chlorine and by aqua regia. J. J. S.

Diamonds from Steel. By A. Rossel (*Compt. rend.*, 1896, **123**, 113—115; compare Moissan, Abstr., 1893, ii, 275; 1894, ii, 189).—Small diamonds have been obtained from hard steels produced at high temperatures and cooled under great pressure. The steels were treated according to the methods recommended by Berthelot (*Ann. Chim. Phys.*, [4], **19**, 392), and by Moissan (*loc. cit.*).

The crystals have the same form, appearance, and properties as those described by Moissan. J. J. S.

Action of Zinc on the Photographic Plate. By R. Colson (*Compt. rend.*, 1896, **123**, 49—51).—The author shows that if a piece of zinc foil, which has been kept for some time, be partially rubbed with emery paper and then placed in contact with a gelatinobromide plate for some 24 hours, the plate on development takes on a deep grey tint where the recently rubbed zinc rested, a lighter grey tint where the bright but not recently rubbed surface rested, and that scarcely any change at all is noticeable where the oxidised surface of the zinc came in contact with the plate. This action is due to minute traces of zinc vapour which are given off at ordinary temperature and pressure from a freshly polished zinc surface; the emanation of vapour, however, diminishes as the surface becomes oxidised.

The image is only formed after development, and the author thinks that in certain cases the light used in photography may be replaced by polished zinc-foil.

The zinc vapour has the power of penetrating all porous substances, such as paper, thin strips of wood, &c. Compact substances are opaque to the vapour.

Magnesium and cadmium have the same action on a gelatinobromide plate, but not lead, tin, copper, iron, or aluminium.

J. J. S.

Vaporisation of Metals at the Ordinary Temperature. By Henri Pellat (*Compt. rend.*, 1896, **123**, 104—105; compare Colson, preceding abstract).—Experiments made by the author some four years ago show that steel has an action on a photographic plate even when separated from it by a sheet of cardboard. The steel used was in the form of a magnetised bar, the exposure varied from 15 days to several months, and all precautions were taken to exclude light. The action is attributed to the vaporisation of the steel at ordinary temperatures, and to the passage of the vapour through the cardboard.

J. J. S.

Preparation of Alloys. By Henri Moissan (*Compt. rend.*, 1896, **122**, 1302—1303).—Many alloys can be obtained by taking advantage of the ease with which metallic oxides are reduced by aluminium. The general method is to throw a mixture of aluminium filings and the oxide of the particular metal into melted aluminium. Part of the aluminium burns, and there is such an energetic development of heat that the most refractory oxides are reduced, the metal mixing with the excess of aluminium. In this way alloys of aluminium with nickel, molybdenum, tungsten, uranium, and titanium, have been prepared. An alloy can be obtained containing as much as 75 per cent. of tungsten.

The direct preparation of a copper-chromium alloy is difficult, but an aluminium-chromium alloy is readily obtained in the manner indicated, and this dissolves in all proportions in fused copper forming a copper-aluminium-chromium alloy, from which the aluminium is readily eliminated by stirring in cupric oxide, a copper-chromium alloy being left. A similar method can be applied to the introduction of tungsten and titanium into Siemens-Martin steel. C. H. B.

Fusibility of Metallic Alloys. By Henri Gautier (*Compt. rend.*, 1896, **123**, 109—113).—Fused alloys, on solidification, behave in a similar manner to fused mixtures of salts, and hence may be divided into three classes corresponding with the three classes of saline mixtures recognised by Le Chatelier.

(1) The metals do not combine in any fixed proportions, and the two constituents crystallise quite distinctly; for example, alloys of tin with zinc, bismuth, or lead.

(2) A definite compound of the two metals crystallises out, but these crystals are scattered in a crystalline matrix of the metal which is in excess; for example, copper with tin or antimony.

(3) Alloys corresponding with isomorphous mixtures of salts; for example, gold with silver.

The fusibility curve of an alloy at once indicates to which of these three classes the alloy belongs.

The author has studied the fusibility of four alloys, tin-nickel, tin-aluminium, aluminium-silver, and antimony-aluminium, and the results show that all four alloys belong to the second class. The curves indicate the following definite compounds, Ni_3Sn_2, SnAl, or Sn_3Al_2, Ag_2Al, and SbAl.

Of antimony-aluminium alloys, all which contain more than 2 per cent. of antimony are less fusible than aluminium, and thus form an exception to the rule that binary alloys fuse more readily than the less fusible constituent. Antimony-aluminium alloys, which approximate in composition to SbAl, have the curious property of being slowly and spontaneously reduced to a powder, and the powder thus formed does not melt below 1100°, although the least fusible of these alloys melts at 1050°. The author gives the melting point of antimony, as determined by the pyrometer, as 632°, and not 430°, as stated in text-books. J. J. S.

Action of Phosphorus on Metallic Chlorides. By A. Granger (*Compt. rend.*, 1896, **122**, 1484—1485).—Phosphorus vapour at a low red heat converts nickel and cobalt chlorides into the corresponding sesquiphosphides Ni_2P_3 and Co_2P_3. The former is grey, very friable, has a graphitic lustre, and a crystalline and schistose structure, whilst the latter is black, has a metallic lustre, and is readily powdered. These sesquiphosphides are not magnetic; they are not attacked by hydrochloric or nitric acid, or by aqua regia, and chlorine begins to decompose them only at the melting point of hard glass. They do not alter on exposure to air at a dull red heat, but lose phosphorus when heated in a blow-pipe flame.

Mercuric, stannic, and cadmium chlorides are not affected by phosphorus vapour under similar conditions, and gold and silver chlorides are reduced to the metallic state. Cupric chloride is reduced to cuprous chloride, and eventually yields copper diphosphide if the temperature is below dull redness; at a higher temperature, the composition of the crystalline product is not constant but varies between CuP_2 and Cu_2P_2. C. H. B.

Action of High Temperatures on certain Sulphides. By A. Mourlot (*Compt. rend.*, 1896, **123**, 54—57).—Amorphous lead sulphide, when heated in the electric furnace for eight minutes with a current of 35 volts and 50 ampères, yields crystals of galena; when heated for 40 minutes, a mixture of galena and metallic lead is obtained, and with stronger currents, metallic lead alone.

Antimony sulphide behaves in a similar manner, yielding stibnite and the metal; with a current of 300 ampères and 60 volts, however, it is completely desulphurised in a few minutes.

Amorphous zinc sulphide yields würtzite, cadmium sulphide yields greenockite, and aluminium sulphide forms a crystallised variety when similarly treated. J. J. S.

Desilverisation of Lead by Electrolysis. By Donato Tommasi (*Compt. rend.*, 1896, **122**, 1476—1477).—The argentiferous lead is cast into convenient forms, and is made the anode in a solution of lead sodium acetate, or lead potassium acetate, which has a very low resistance, and does not yield any lead peroxide on electrolysis. The cathode is a disc of some metal which is not attacked by the liquid; the general arrangement of the electrolytic cell has previously been described (this vol., ii, 511). When the circuit is complete, the lead is transferred from the anodes to the cathode in a spongy form which is readily removed from time to time, whilst the silver falls into a perforated receiver placed below the anode. The lead is afterwards fused with charcoal and the silver with sodium nitrate and borax. C. H. B.

Aluminium Alloys. By Charles Combes (*Compt. rend.*, 1896, **122**, 1482—1484).—When aluminium alloys are prepared by adding a mixture of a metallic oxide and aluminium powder to fused aluminium as proposed by Moissan (this vol., ii, 601), there is loss of aluminium and the alumina which is formed does not separate readily from the alloy. Better results are obtained by adding the sulphide or chloride of the particular metal to the fused aluminium; in the first case the aluminium sulphide rises to the surface of the metal, in the second the aluminium chloride volatilises. Metallic sulphides can be employed when the heat of formation is lower than that of aluminium sulphide; the chlorides can often be used even when their heat of formation is somewhat higher than that of aluminium chloride. When sulphides are used, part of the sodium that is often present in aluminium is eliminated in the sulphide formed.

Aluminium-nickel alloys containing 20 per cent. of nickel were prepared by means of the sulphide; aluminium-manganese alloys containing 4 per cent. of manganese were prepared by means of anhydrous manganous chloride, and have a crystalline fracture resembling that of spiegeleisen. Aluminium-chromium alloys were obtained by using chromic chloride; one containing 7 per cent. of chromium is very brittle, and has a finely crystalline structure, whilst another containing 13 per cent. of chromium is completely crystalline and can be powdered in a mortar. C. H. B.

Hydrolytic Decomposition of Ferric Nitrate and Sulphate. By Ubaldo Antony and G. Gigli (*Gazzetta*, 1896, **26**, i, 293—311).—The authors have examined ferric nitrate and sulphate by methods similar to those which they used with ferric chloride (this vol., ii, 250).

On evaporating concentrated ferric nitrate solution, in which the dissolved matter has the composition $Fe(NO_3)_3$, at ordinary temperatures, nitric acid is given off. The dissociation of pure ferric nitrate in aqueous solutions, just as in the case of the chloride, increases with the dilution and also with the time elapsing since the preparation of the solution. The salt in the more dilute solutions becomes completely dissociated after a time into colloïdal ferric hydroxide and nitric acid, as is shown by the facts that sodium chloride precipitates ferric hydroxide, and that potassium ferrocyanide gives no blue coloration in such solutions; in less dilute solutions, to which ferrocyanide has been added, the blue colour gradually increases in intensity owing to the continued re-formation of the ferric nitrate. Aqueous solutions of ferric nitrate containing less than 0·1 per cent. are quite colourless, thus differing from other dilute solutions of ferric salts which are always coloured; it is supposed that in such dilute ferric nitrate solutions, basic ferric salts are not formed, but rather salts of pyronitric acid, $H_4N_2O_7$, or orthonitric acid H_5NO_5. Ferric orthonitrate and pyronitrate being simply products of hydrolysis of ferric nitrate, the reaction between all three salts and water is a reversible one; the orthonitrate by further hydrolysis dissociates into ferric hydroxide and nitric acid. Although differing in a few respects, ferric nitrate and ferric chloride solutions behave on the whole very similarly on dilution; solutions of ferric sulphate, however, behave dissimilarly to these two. Clear neutral ferric sulphate solution remains clear until highly diluted, when it becomes gradually turbid owing to deposition of ferric hydroxide; ferric sulphate thus undergoes hydrolytic dissociation in aqueous solution and the dissociation becomes complete in solutions of about 1 in 60,000, sulphuric acid and non-colloïdal ferric hydroxide being formed. During the decomposition, true basic ferric salts are first formed and ultimately converted into insoluble ferric hydroxide. The ferric sulphate is slowly reformed on disturbing the equilibrium by adding potassium ferrocyanide if the solution be not too dilute to allow of the solution of the ferric hydroxide in the sulphuric acid.

The amounts of water necessary to decompose equivalent quantities of ferric chloride, nitrate, and sulphate are approximately in the ratio of the avidity constants of the three acids; the slight divergence in the case of the sulphate being attributed to the fact that the ferric hydroxide does not remain colloïdal in presence of sulphuric acid. W. J. P.

Compounds of the Lower Oxides and Sulphides of Molybdenum with Ammonia and with Potassium Cyanide. By K. VON DER HEIDE and KARL A. HOFMANN (*Zeit. anorg. Chem.*, 1896, **12**, 277—292).—The *compound* $4MoO_3,MoO_2,2NH_3 + 7H_2O$ is obtained by heating an aqueous solution of ammonium molybdate with half its weight of hydroxylamine hydrochloride on the water bath until the orange precipitate which is at first formed is dissolved, and a greenish-brown solution is obtained; this solution is then rapidly filtered, protected from access of air, and allowed to cool. The compound separates in dark red crystals belonging to the triclinic system, dissolves gradually in water with a reddish-yellow coloration, and is fairly stable. It gradually reduces Fehling's solution in the cold and quickly when heated. With copper sulphate, it gives a beautiful, blue coloration; with mercurous and mercuric salts, a flesh coloured precipitate; with lead nitrate, a yellowish-white precipitate; and with potassium thiocyanate, an intense red coloration. It is gradually decomposed by dilute acids, and reduces ammoniacal silver solution with separation of metallic silver. The authors were unable to obtain other ammonia derivatives with the lower oxides of molybdenum, analogous to the chromamine bases.

The *compound* $MoO_2,4KCN,NH_2\cdot OH + H_2O$ is obtained on heating a solution of molybdic acid (10 grams) in an excess of potassium hydroxide with potassium cyanide (20 grams) and hydroxylamine hydrochloride (5 grams); nitrogen is evolved, and the heating is continued until a reddish-violet solution is obtained. On cooling, the compound crystallises in beautiful, violet, monoclinic forms, the aqueous solution of which is red, and shows a characteristic absorption in the green. Yellow oxidation products are gradually formed on exposure to the air. The compound is decomposed by dilute acids with an intense red coloration, and evolution of hydrogen cyanide. It is easily decomposed by strong reducing agents, sodium amalgam, or excess of hydroxylamine, and gives precipitates with mercury, lead, and iron salts. It is not altered by yellow ammonium sulphide in the cold, and, on heating, yields molybdenum trisulphide.

The *compound* $MoO_2,4KCN + 10H_2O$ is obtained as follows: molybdenum trioxide is treated with potassium iodide and hydrochloric acid, and the liberated iodine eliminated by steam distillation; the greater portion of the hydrochloric acid is then removed by evaporation, and the solution neutralised with potassium hydroxide, and mixed with a concentrated solution of potassium cyanide. As soon as the solution changes to a beautiful blue, a large excess of potassium hydroxide is added, whereby the compound is precipitated. It crystallises in bluish-red tablets belonging to the rhombic system; $a : b : c = 0·7324 : 1 : 0·5723$. It is not decomposed by cold dilute acids, but with concentrated sulphuric acid, it gives a black precipitate insoluble in ammonia, and it is decomposed by concentrated hydrochloric and nitric acids without the formation of a precipitate. With silver nitrate, it yields a black precipitate, which, on treatment with nitric acid, is converted into silver cyanide. It gives a green coloration with ammonium sulphide, and, on heating, yields sulphomolybdate. With thiocyanates in acid solution, it yields a red compound, which can be extracted by shaking with ether. On precipitating with alcohol the blue mother liquors obtained in the preparation of this salt, and crystallising the precipitate from a small quantity of water, bright, greenish-blue plates were obtained of the formula

$$MoO_2,4KCN + 5H_2O,$$

and a further crystallisation of the mother liquors yielded compounds which, on analysis, gave numbers agreeing with the formulæ $MoO_2CN,3KCN + H_2O$; $MoO_2CN,3KCN$, and $MoO_2,3KCN + 4H_2O$.

Hydrated molybdenum bisulphide dissolves in potassium cyanide to an intensely green solution, and, on adding alcohol, a greenish oil is precipitated, which gradually solidifies. According to the length of time which is allowed for the action of the potassium cyanide, three different compounds are obtained.

The *compound* $Mo_2S_3,6KCN + 5H_2O$ is obtained by a mild action of the cyanide for a short time. It crystallises in green needles having a silky lustre, is easily soluble in water, and is not altered by alkalis, but is gradually decomposed by dilute mineral acids. It yields characteristic precipitates with mercury, copper, silver, and ferric salts. When warmed with ammonium sulphide, a thiomolybdate is formed.

The *compound* $Mo_2SO(CN)_2,4KCN + 4H_2O$ is obtained by evaporating the solution of the bisulphide in potassium cyanide in a vacuum at the ordinary temperature. It crystallises in beautiful, reddish-brown needles, easily soluble in water; it is stable towards dilute acids and alkalis, but is decomposed by boiling with hydroxylamine with the formation of a red precipitate.

The *compound* $Mo_3S_4(CN)_3,5KCN + 7H_2O$ is obtained by allowing the preceding salt to remain in contact with the mother liquor over sulphuric acid. It separates in large crystals resembling black augite, and appears green by transmitted light. It gives a green solution in water, is not altered by dilute acids or alkalis in the cold, yields a thiomolybdate when warmed with ammonium sulphide, and gives precipitates with copper, lead, and mercury salts. With silver nitrate, it yields a blackish-brown precipitate, which is converted into silver cyanide when treated with nitric acid. E. C. R.

Researches on Tungsten. By Henri Moissan (*Compt. rend.*, 1896, **123**, 13—16; compare Abstr., 1893, ii, 471).—Tungsten, in a state of purity, may readily be obtained by heating a mixture of tungstic acid (800 grams) with sugar carbon (80 grams) in the electric furnace, the heating being continued for 10 minutes with a current of 900 ampères and 50 volts. A residue is left which, although distinctly molten on the surface, is quite porous internally.

If the complete fusion of the metal is avoided, the carbon of the crucible does not take part in the reaction, and the excess of tungstic acid is volatilised. The metal, as thus obtained, contains no carbon and is very pure. In the porous state it can be welded like iron; it can also be filed easily, and, when free from carbon, will not scratch glass. When heated with carbon, as in the cementation process, the exterior portions contain carbon, and become hard enough to scratch rubies.

Pure tungsten is less fusible than chromium or molybdenum; it has a sp. gr. = 18·7, and has no action on a magnetised needle.

Fluorine attacks the metal at the ordinary temperature with incandescence, and yields a volatile fluoride; neither nitrogen nor phosphorus has any action on tungsten at a red heat. Silicon and boron, if heated in the electric furnace with tungsten, yield crystalline compounds of metallic lustre, which are capable of scratching rubies. At 1200°, carbonic anhydride is reduced by tungsten, yielding the blue oxide, but no carbon is deposited. The metal is not readily acted on by moist air, but is slowly attacked by water containing carbonic anhydride. Sulphuric, hydrochloric, and hydrofluoric acids act but slowly, whereas a mixture of hydrofluoric and nitric acids dissolves the metal readily. Oxidising agents, such as lead dioxide and potassium chlorate, readily act on the powdered metal.

If, in the preparation of tungsten, the heating is continued for a longer time, the metal melts and combines with the carbon of the crucible. With an excess of carbon, the metal readily forms a definite *carbide*, CW_2; this is iron-grey, is harder than corundum, and at 18° has a sp. gr. = 16·06; it has much the same properties as the metal, but is, as a rule, more readily acted on. Boiling nitric acid readily dissolves the carbide, whereas other acids act but slowly.

J. J. S.

Zirconotungstic Compounds. By L. A. Hallopeau (*Compt. rend.*, 1896, **122**, 1419—1422).—Gelatinous zirconium oxide, prepared by the action of potassium hydroxide on potassium fluorozirconate, dissolves in a boiling solution of potassium paratungstate,

$$12WO_3,5K_2O + 11H_2O,$$

and yields a *zirconodecatungstate*, $10WO_3,ZrO_2,4K_2O + 15H_2O$; this separates from boiling water in small crystals, which act feebly on polarised light. The mother liquor of this salt, when concentrated in a vacuum, yields a *dizirconodecatungstate*, $10WO_3,2ZrO_2,4K_2O + 20H_2O$, in very small, prismatic crystals, which act strongly on polarised light, and show extinction at 30° from the axis of elongation. Both these compounds are almost insoluble in cold water, are converted into insoluble compounds when heated, and yield a mixture of tungstate and zirconate when fused with alkali carbonates. In general properties, they resemble the silicotungstates; the zirconodecatungstate is analogous in composition to the silicodecatungstate, except that it contains a somewhat smaller proportion of water.

Ammonium zirconodecatungstate, $10WO_3,ZrO_2,3(NH_4)_2O,H_2O + 13H_2O$, is obtained in a similar way, and forms small, rhomboidal prisms, which act strongly on polarised light and show extinction parallel with the axes. The crystals lose water even in contact with the liquid in which they are formed.

The zirconodecatungstates are immediately decomposed by nitric, hydrochloric, or sulphuric acid, with precipitation of tungstic acid, and acetic acid behaves in a similar manner. Phosphoric acid precipitates gelatinous zirconium phosphate. Ammonia precipitates zirconium hydroxide, and the precipitate does not redissolve when the liquid is boiled and the ammonia expelled. In the case of the silicodecatungstates, the precipitate redissolves. Potassium hydroxide produces a similar precipitate, and the salts of many metals precipitate insoluble zirconodecatungstates. C. H. B.

Action of Iodine on Stannous Chloride. By V. THOMAS (*Compt. rend.*, 1896, **122**, 1539—1541).—When iodine is added to stannous chloride in presence of carbon bisulphide, the liquid is at first rapidly decolorised, and, in the end, remains orange-red. If the bisulphide, in which stannous chloride is quite insoluble, is decanted off and distilled, it is found to contain stannic iodide and iodine trichloride; these can be separated by heating at 150—200°, when the latter volatilises and the iodide is left in a well crystallised form. No stannic chloriodide is obtained, and the reaction seems to be represented by the equation $3SnCl_2 + 7I_2 = 3SnI_4 + 2ICl_3$.

C. H. B.

Vanadium and Vanadium Carbide. By HENRI MOISSAN (*Compt. rend.*, 1896, **122**, 1297—1302).—Vanadic anhydride (182 grams), mixed with sugar carbon (60 grams), in quantities of 300 grams at a time, is heated for 5 minutes in the electric furnace with a current of 900 ampères and 50 volts. In this way, vanadium is obtained containing 10·5 to 16·2 per cent. of carbon, but if the proportion of sugar carbon amounts to one-fifth of the vanadic anhydride, the reduced vanadium contains 9·2 to 9·9 per cent. of carbon (compare Abstr., 1893, ii, 471). The volatility of the vanadic anhydride makes its reduction difficult, and likewise interferes with the subsequent purification of the vanadium. However, by heating vanadic anhydride for two minutes only in an atmosphere of hydrogen in a carbon tube in the electric furnace with a current of 1,000 ampères and 60 volts, the reduced metal contains only 4·4 to 5·3 per cent. of carbon. It is then white, has a brilliant lustrous fracture, and does not alter when exposed to air; sp. gr. = 5·8 at 20°. It burns in oxygen at a red heat, and is attacked by chlorine at dull redness, but does not become incandescent, and combines readily with nitrogen. It is not affected by hydrochloric acid, and only very slowly by boiling concentrated sulphuric acid.

If the mixture of vanadic anhydride and carbon is heated in the carbon tube of the electric furnace for 9 or 10 minutes, *vanadium carbide* is obtained; this has the composition VC, forms distinct crystals, scratches quartz, melts at a temperature somewhat above the melting point of molybdenum, and is volatile; its sp. gr. is 5·36. It becomes incandescent if heated in chlorine above 500°, burns vigorously in oxygen at a dull-red heat, but does not combine with sulphur at the melting point of glass, and does not react with hydrogen chloride, water vapour, or hydrogen sulphide at dull redness.

Nitrogen and ammonia attack it readily at a red heat, with formation of a nitride. Sulphuric and hydrochloric acids have no action on it, but it is attacked by nitric acid in the cold, and is oxidised readily by fused potassium nitrate or chlorate.

Vanadium, notwithstanding its high melting point, readily forms alloys. A mixture of ferric oxide, vanadic anhydride, and sugar carbon, when heated in the electric furnace, yields a greyish-white, crystalline, brittle alloy containing nearly 20 per cent. of vanadium, and about 8 per cent. of carbon. With copper oxide in place of ferric oxide, an alloy containing 96·52 per cent. of copper and 3·38 per cent. of vanadium is obtained; it is very malleable, is easily filed, and is harder than copper. An alloy of aluminium with 2·5 per cent. of vanadium is obtained by throwing a mixture of vanadic anhydride and aluminium filings into fused aluminium; it is very malleable, but too soft to be filed readily. Silver and vanadium do no not form an alloy. C. H. B.

Action of Nitric Peroxide on Antimony Trichloride. By V. Thomas (*Compt. rend.*, 1896, **123**, 51—54; compare Abstr., 1895, ii, 450).—Antimony trichloride absorbs but little nitric peroxide in the cold, but at its melting point it readily absorbs the gas, becoming first pale yellow, then dark, and finally red. If slowly cooled, it still retains a yellow colour, and contains a certain quantity of the peroxide; it loses the gas, however, when placed in a vacuum or when left exposed for some time to dry air. The question as to whether the peroxide is chemically combined with the chloride or only exists in a state of solution, has been settled by the author by determining the vapour tension of the gas evolved at given temperatures. If a definite compound exists, then it must dissociate at the ordinary temperature, and, according to the laws of dissociation, the tension should remain constant for a given temperature. It was impossible to measure the vapour tension directly on account of the action of nitric peroxide on mercury, but it was accomplished indirectly by estimating the amount of peroxide present in a known volume of the mixed gases by absorbing the peroxide with dilute alkali, and titrating the nitrite formed with potassium permanganate. The vapour tension varied from 3 mm. to 491 mm. for the same temperature (22·5°), thus indicating that the peroxide forms no definite compound with antimony trichloride, but simply remains dissolved.

J. J. S.

Solubility of Carbon in Rhodium, Iridium, and Palladium. By Henri Moissan (*Compt. rend.*, 1896, **123**, 16—18; compare Abstr., 1893, ii, 320).—Rhodium, when heated in the electric furnace in the presence of carbon, takes up a small quantity of the latter. With a current of 300 ampères and 50 volts, 1·42 per cent. of carbon was dissolved; with a current of 910 ampères and 50 volts acting during 5 minutes, a larger quantity of carbon, 2·72—7·38 per cent., was absorbed. The greater the amount of carbon the metal contains, the less malleable it becomes; this carbon is left behind in the form of graphite when the metal is heated and chlorine is passed over it.

Iridium and palladium react in a similar manner, dissolving carbon at the temperature of the electric furnace, but yielding it up again, before they solidify, in the form of crystals of graphite.

J. J. S.

Mineralogical Chemistry.

Reproduction of Sodium Magnesium Chlorocarbonate, Sodium Magnesium Carbonate, Darapskite, and Hydrargillite. By August B. de Schulten (*Compt. rend.*, 1896, **122**, 1427—1429).—Sodium magnesium chlorocarbonate is obtained by heating 150 grams of sodium chloride, 20 grams of sodium carbonate (anhydrous), and 15 grams of magnesium chloride with 550 c.c. of water in a closed flask for eight hours at 100°; it separates in regular octahedra of the composition $Na_2CO_3,MgCO_3,NaCl$; sp. gr. = 2·377 at 15°. It is decomposed by cold water, and melts and decomposes at a red heat.

The double carbonate is obtained by reducing the proportion of sodium chloride and increasing that of the carbonate. A good method is to mix a solution of 20 grams of crystallised magnesium nitrate in 50 c.c. of water with a solution of 100 grams of anhydrous sodium carbonate in 400 c.c. of water, and heat the mixture in a closed flask at 100° for 4—5 hours; it crystallises in flat rhombohedra of the composition $Na_2CO_3,MgCO_3$, the acute angle of the face *p* being about 73°; sp. gr. = 2·729 at 15°.

Artificial darapskite, $NaNO_3,Na_2SO_4,H_2O$, is obtained by dissolving 250 grams of crystallised sodium sulphate in 500 grams of water, adding 400 grams of sodium nitrate, and allowing the filtered liquid to cool slowly. The crystals do not alter at the ordinary temperature but lose water slowly at 100°; sp. gr. = 2·197 at 15°; they are monoclinic, elongated along *h'*, showing the faces *p*(001), *g'*(010), *m*(110), *o'*(101), o^3(302), a^1($\bar{2}$01), the angles being *h'p* 76° 50', *h'm* 56° 0', *h'o'* 54° 0', *h'*o^3 44° 50', and *h'*a^1 52° 50', which are practically identical with those of the natural mineral.

Hydrargillite (gibbsite) is obtained in distinct crystals by precipitating aluminium hydroxide from a very dilute ammoniacal solution, and heating on a water bath for 15 days. Better results are obtained by slowly precipitating the hydroxide from a hot alkaline solution by means of carbonic anhydride. The crystals contain a small quantity of silica; sp. gr. = 2·423. They show the faces *p*(001), *h'*(100), and *m*(110): the angles *h'm* and *mm* are very nearly 120°, and in crystals macled along *h'*, the angle *pp* is about 9°, and hence C = 85° 30'. On *g'* extinction takes place at an angle of about 20° towards the acute angle of the edges *p* and *h'*. On *h'* the extinction is longitudinal, and the elongation is positive in the direction of the longitudinal edges of the prism.

C. H. B.

Witherite from Przibram. By A. Hofmann (*Ber. k. böhm. Ges.*, 1896, [1895], No. 15, 1—7).—Witherite has recently been found at one point in the mineral veins of the Przibram district, Bohemia, as greyish- to yellowish-white, pyramidal crystals, which have the usual polysynthetic structure and show curved and uneven faces. Analysis of water-clear material gave

BaO.	CaO.	SrO.	FeO.	CO_2.	Insol.	Total.	Sp. gr.
77·54	0·09	trace	0·14	22·16	0·38	100·31	4·25

It is suggested that the witherite has been formed by the action of alkali carbonates, produced by the decomposition of diabase, on barytes, at a temperature higher than 25°; the barytes of the first generation of the district being often corroded and represented by pseudomorphs. L. J. S.

Chrysocolla in Andesite-tuff. By Gyula Pethö (*Földtani Közlöny*, 1895, **25**, 236—237).—Amorphous chrysocolla occurs as crusts and cementing the lapilli in an andesite-tuff, near Guravoj, county of Arad, Hungary; the colour is various shades of green and blue. In the interior are radiated patches of malachite, indicating that the copper was first deposited in the tuff as malachite, which was afterwards altered to chrysocolla. Analysis by A. Kalecsinszky gave SiO_2, 40·20; CuO, 37·37 per cent. L. J. S.

Variations in the Composition of Apatites. By Adolphe Carnot (*Compt. rend.*, 1896, **122**, 1375—1380).—Several specimens of apatite from such widely separated localities as Spain, the Tyrol, Norway, &c., and of very different external appearance, were found to correspond in composition with the well-known formula of Rose. Two specimens from Canadian localities and one from the United States were found to contain a proportion of halogen considerably lower than the normal amount. These specimens, however, contained calcium carbonate, and the carbonic acid therein was found to be equivalent to a quantity of fluorine just sufficient to bring the proportion of halogen up to the normal amount. It would seem, therefore, that calcium carbonate as well as calcium chloride can replace the calcium fluoride. When heated in sealed tubes at 160° with sodium carbonate solution, apatite containing fluorine only was but slightly affected, but apatite containing chlorine also was appreciably altered.

Two transparent, yellowish varieties of apatite from the Tyrol were found to contain a very low proportion of halogen, and practically no calcium carbonate. The cause of this abnormal composition is uncertain, but it is noteworthy that these specimens had no outward crystalline form, although they showed the cleavage, and the optical properties of true apatites. C. H. B.

An Alpine Nickel-bearing Serpentine. By Emily A. Aston and Thomas George Bonney (*Quart. Journ. Geol. Soc.*, 1896, **52**, 452—460).—The rock is from the summit of the Riffelhorn, near Zermatt; microscopical examination shows the presence of a colourless, flaky, serpentinous mineral, an augite, magnetite, and awaruite. As shown by the analytical results (I), half the minerals must be anhydrous, and the amount of iron is not much more than sufficient for the magnetite and awaruite. The amount of nickel present in the awaruite is less than 1 per cent., and the remainder replaces calcium in the pyroxene. Sp. gr. of the rock, 2·71.

	SiO_2.	Al_2O_3.	As_2O_3.	Fe_2O_3.	FeO.	CuO.	NiO.	CaO.
I.	41·81	0·68	0·13	5·55	1·42	0·15	4·92	trace
II.	40·26	3·61	—	2·58	2·69	—	—	—

	MgO.	Na_2O.	H_2O (combined).	Moisture.	Total.
I.	39·86	—	4·90	0·04	99·46
II.	41·35	0·71	9·51	0·17	100·88

Another fragment gave Analysis II (mean of two); here calcium and nickel are both absent, and the figures are nearer to those of an ordinary serpentine, although the alumina is somewhat high. The fulgurites, or lightning-tubes, in these rocks are described in detail.

L. J. S.

[Analysis of Orthoclase from an Odenwald Granite.] By C. CHELIUS (*Jahrb. f. Min.*, 1896, ii, 69—71; from *Notizbl. Ver. f. Erdkunde, Darmstadt*, 1894, [4], **15**, 16—39).—Analysis I is of the older granite from Oberwald, near Steinau; the rock contains porphyritic crystals of orthoclase (Analysis II), and in the ground mass there is much plagioclase: hornblende is also present.

	SiO_2.	Al_2O_3.	TiO_2.	Fe_2O_3.	FeO.	CaO.	MgO.
I.	63·86	17·87	0·03	1·24	2·88	3·33	0·99
II.	69·30	14·28	—	0·42	0·28	2·03	0·14

				H_2O.			
	K_2O.	Na_2O.	P_2O_5.	Chem. comb.	Hygroscopic.	SO_3.	Total.
I.	3·56	4·10	0·65	0·84	0·17	—	99·52
II.	9·79	2·11	0·60	0·39	0·07	0·33	99·74

L. J. S.

The Mode of Occurrence of Gold in the Ores [Rhyolite] of the Cripple Creek District. By RICHARD PEARCE (*Proc. Colorado Sci. Soc.*, 1894, **5** [Read January 8, 1894], 8 pp.).—The Cripple Creek ore is a rhyolite, having the joints and cracks lined by psilomelane, with which is associated the gold; pyrites is abundant. In the unaltered rock, gold occurs in combination as telluride (sylvanite), and is associated with fluorite; but in the altered, clayey portions it occurs free, either in a fine state of division or as brittle plates pseudomorphous after sylvanite, the tellurium here being in the oxidised form, as is shown by the fact that it can be readily extracted by hydrochloric acid. The ratio of tellurium to gold in the oxidised ore is higher than that required for sylvanite, indicating that other tellurium minerals (possibly native tellurium) must have been originally present, or that some of the gold has been subsequently removed. It is suggested that the ore has originated by solutions having impregnated the rock with pyrites and sylvanite.

L. J. S.

Further Notes on Cripple Creek Ores. By RICHARD PEARCE (*Proc. Colorado Sci. Soc.*, 1894, **5**, [Read April 5, 1894], 7 pp.).—The following analyses, by F. C. Knight, are given of the unoxidised portion (I) and of the oxidised portion (II) of a single specimen of the rhyolite which forms the Cripple Creek ore.

	SiO_2.	Al_2O_3.	Fe_2O_3.	Fe.	S.	SO_3.	MgO.	Te.	TeO.
I.	56·70	19·35	—	4·20	4·75	—	0·37	0·10	—
II.	50·55	19·93	10·57	—	—	2·55	0·12	—	0·78

	Au.	Ag.	MnO_2.	H_2O.	K_2O,Na_2O [diff.].
I.	0·041	0·022	—	0·50	[13·967]
II.	0·049	—	0·27	3·05	[12·131]

In the unoxidised portion of the rock, pyrites and sylvanite are present; although the latter is not visible, even with the aid of a lens, its presence is indicated by the relative proportions of gold, silver, and tellurium shown in the analysis. In the oxidised rock, the pyrites is represented by a hydrated basic ferric sulphate near glockerite, the tellurium is present as oxide, and the gold is free, the latter being rarely visible as a soft, brownish deposit. L. J. S.

A suspected New Mineral from Cripple Creek. By F. C. KNIGHT (*Proc. Colorado Sci. Soc.*, 1894, **5**, [Read October 1, 1894], 6 pp.).—R. Pearce has previously pointed out the existence of tellurium in an oxidised form in the Cripple Creek ores (see preceding abstracts), and in this paper it is shown to be present as an *iron tellurite*. The specimen examined consists of a crystalline telluride intimately associated with a light brown, brittle, amorphous matrix. Analysis of the whole gave the following results.

	Sol. in HCl.			
H_2O.	Fe_2O_3.	TeO_2.	SeO_2.	Ag.
0·45	8·12	17·81	0·45	0·22

Insol. in HCl.					
SiO_2.	Au.	Ag.	Te.	Se.	Total.
38·25	18·41	1·20	14·72	0·32	99·95

From the portion insoluble in hydrochloric acid, the telluride was dissolved by nitric acid, and the free gold by aqua regia. The tellurium is present as tellurous, and not as telluric, oxide, as is shown by the fact that no chlorine was evolved, and no gold dissolved, when the material was treated with hydrochloric acid. Eliminating silver (which is present owing to the solubility of silver chloride in tellurium tetrachloride) and calculating to 100, the portion soluble in hydrochloric acid gave the results under I; with another specimen, the results under II were obtained.

	Fe_2O_3.	$TeO_2 + SeO_2$.	H_2O.	Total.
I.	30·27	68·05	1·68	100·00
II.	35·44	62·79	1·77	100·00

The first of these corresponds with the formula $2(Fe_2O_3,2TeO_2) + H_2O$. The crystalline telluride when separated from the matrix gave, on analysis, the following results, showing its identity with calaverite (compare this vol., ii, 31).

Au.	Te.	Ag.	Total.
40·14	56·22	3·63	100·00

L. J. S.

Analyses of Spherulites and Matrix of Rocks. By HUGH H. F. HYNDMAN and THOMAS GEORGE BONNEY (*Geol. Mag.*, 1896, **3**, 365—371).—Analyses are given of the sea-green matrix (I) and of the reddish spherulites (II) of a pyromeride (rhyolite) from Boulay Bay, Jersey. Under the microscope, the matrix shows a mosaic of quartz and felspar, with plumes and granules of a chloritic mineral and ferrite; the spherulites are not unfrequently traversed by veins of chalcedonic quartz.

	SiO_2.	Bi_2O_3, &c.	Al_2O_3.	Fe_2O_3.	FeO.	CuO, &c.	NiO.	CaO.
I.	78·40	0·58	8·81	—	4·02	trace	0·29	0·57
II.	73·23	0·51	11·45	4·50	—	0·30	trace	0·38

	MgO.	K_2O.	Na_2O.	H_2O.	Total.
I.	0·20	2·62	3·06	1·53	100·08
II.	0·02	2·77	5·14	0·81	99·11

The matrix therefore contains more quartz and more orthoclase, relatively to albite, than the spherulites; analyses of the matrix and spherulites of an artificial glass, however, show these relations reversed. L. J. S.

The Costilla Meteorite. By RICHARD C. HILLS (*Proc. Colorado Sci. Soc.*, 1895, **5**, [Read January 7, 1895], 2 pp.).—This meteorite, which weighs about 78 lbs., was found in August, 1881, on the north slope of Costilla Peak, about six miles south of the boundary line between Colorado and New Mexico. The etched surface shows bands of kamacite and tænite parallel to the octahedral cleavage. A little troilite, schreibersite, and a substance like graphite are present. An analysis by L. G. Eakins gave

Fe.	Ni.	Co.	P.	S.	Total.
91·65	7·71	0·44	0·10	0·26	100·16

L. J. S.

Meteorite of Lesves. By ALPHONSE F. RENARD (*Bull. Acad. Belg.*, 1896, [3], **31**, 654—663).—A meteorite weighing nearly 2 kilos. fell at Lesves in Belgium on April 13th, 1896, burying itself 40 cm. in the ground. Analysis by Stöber gave

SiO_2.	Al_2O_3.	Cr_2O_3.	FeO.	CaO.	MgO.	K_2O.
39·46	3·33	1·02	15·82	1·54	22·75	0·09

Na_2O.	Fe.	Ni.	Co.	S.	Total.	Sp. gr.
1·05	12·36	1·37	0·11	2·25	101·15	3·575

The mineralogical composition is given as

Olivine ($Fe_2SiO_4 + 2\frac{1}{2}Mg_2SiO_4$).	Bronzite ($FeSiO_3 + 3MgSiO_3$).	Nickel- and cobalt-iron.	Troilite. (FeS).	Chromite.
45·88	22·33	9·91	6·18	1·51

Maskelynite and a monosymmetric pyroxene are also probably present.

The structure is chondritic, and both the crystals and the chondrules of olivine and bronzite contain glassy and other enclosures. Under the microscope, the olivine shows undulose extinction and a fragmentary structure similar to morter-structure; it is, therefore, considered that the paste of the meteorite is a product of cataclastic action. In the crust three zones can be distinguished. L. J. S.

Acid Spring near Rome (Ponte Molle). By G. FELICIANI (*Gazzetta*, 1896, **26**, i, 281—289).—The author has examined the water from an acid spring situated several kilometres from the Porta del Popola, Rome, and at the right of the Via Flaminia; the water is reputed to have a therapeutic value, and was analysed by Morichini in 1820, and by Commaille and Lambert in 1859. The middle one of the three sources enjoys the greatest reputation, and was, therefore, most fully examined.

In January, 1895, the water issued at 14·6°, the atmospheric temperature being 10°, and had the sp. gr. at 14·6°/0° of 1·00216. One litre at 0° and 760 mm. contained 356·30 c.c. of free carbonic anhydride, 2·10 c.c. of oxygen, 23·40 c.c. of nitrogen, and the following quantities of various salts in grams.

$NaCl$.	KCl.	$LiCl$.	$MgCl_2$.	KNO_3.	$Na_2B_4O_7$.
0·2669	0·1989	0·0115	0·1546	0·0476	0·0190

$NaHCO_3$.	$CaH_2C_2O_6$.	$CaSO_4$.	SiO_2.
0·6454	0·8411	0·1463	0·0310

The water also contains traces of iron, magnesium, aluminium, and iodine.

This spring thus affords the best natural lithia water to be found in Italy. W. J. P.

Water from the Chalybeate Spring of Óvári. By SIGISMUND NEUMANN (*Földtani Közlöny*, 1895, **25**, 268; from *Math és term. tud. Értesítö*, 1892, **10**, 137—138).—Water from a chalybeate spring near Óvári (near Szathmár, Hungary), contained in parts per 1000: $CaSO_4$, 0·10431; $Ca(HCO_3)_2$, 0·45935; $Fe(HCO_3)_2$, 0·14098; $Mn(HCO_3)_2$, 0·00239; $Mg(HCO_3)_2$, 0·22059; $NaHCO_3$, 0·18014; $NaCl$, 0·04973; KCl, 0·01343; lithium, trace; SiO_2, 0·03170; humic acids, 0·01660; total solids, 1·21922; free CO_2, 0·14216.

L. J. S.

Water of the Kaw River and its Tributaries. By EDGAR H. S. BAILEY and EDWARD C. FRANKLIN (*Kansas Univ. Quart.*, 1894, **3**, 91—102).—Analyses are given of the water taken from the Kaw or Kansas River at different points, and also of the waters of its tributaries.

The waters of the tributaries show considerable differences amongst themselves; for example, the Saline River contains 232·30 parts of total solids in 100,000, whilst the Delaware River contains only 39·56 parts; the Kaw River contains 77 parts of total solids in 100,000. The organic matter in these waters is relatively high, and has been derived from the rich prairie soils. L. J. S.

Physiological Chemistry.

Importance of Digested Crude Fibre as Food. By P. Holdefleiss (*Bied. Centr.*, 1896, **25**, 372—379; from *Ber. phys. Lab. landw. Inst. Univ. Halle*, Heft 12, 52).—The results of direct experiments showed that crude fibre is digested in the rumen, and especially in the cæcum, but not in the abomasum. The crude fibre is partly dissolved by fermentation, and is partly converted into more readily soluble intermediate products, resembling amyloïd.

In order to ascertain the food value of digested crude fibre, experiments were made in which a sheep was fed, first with hay alone, next with half the amount of hay together with earth-nut cake, potato starch, sugar, and salt; in the third period, crude fibre was substituted for starch, whilst in the fourth period, the sheep had the same food as before, except starch and crude fibre. A control experiment was made with a second sheep. From the amounts of food constituents actually consumed, and from the amounts and composition of the excrement, it is concluded that, as compared with that of nitrogen-free extract, the food value of crude fibre is, on the average, as 80 : 100. N. H. J. M.

Fermentative Processes in the Organs. By Cesare Biondi (*Virchow's Archiv*, 1896, **144**, 373—400).—E. Salkowski has described a phenomenon which occurs in the organs after death, and which is not putrefaction. He believes it to be due to the action of an enzyme, and terms it "autodigestion." The most marked action is the formation of amido-acids and substances of the xanthine group. Neumeister considers that the action is simply due to trypsin.

The present research was carried out with calves' livers, and putrefaction was prevented by chloroform water, or sodium fluoride; the former reagent appears to be the most efficacious for the purpose. Salkowski's observations are confirmed. The enzyme, however, is not trypsin, for the following principal reasons: (1) in autodigestion, xanthine-like substances are formed; in tryptic digestion, these are present in a "latent" condition. (2) Autodigestion is not inhibited by an acid medium. (3) Tryptophan, the substance which reacts with bromine water, is a product of tryptic, but not of auto-digestion. W. D. H.

Theory of Lymph-Formation. By Wilhelm Cohnstein (*Pflüger's Archiv*, 1896, **63**, 587—612).—This paper is largely polemical, criticisms being directed chiefly against Mendel (this vol., ii, 315). The author still holds that diffusion and filtration will explain lymph-formation: and although he admits that physical and chemical changes in the protoplasm of the endothelial cells will influence the formation of lymph, he still regards the secretion theory as unproved and unnecessary. W. D. H.

Formation of Sugar by the Liver. By MAX MOSSE (*Pflüger's Archiv*, 1896, **63**, 613—621).—Seegen found, in opposition to Pavy, that the blood of the hepatic vein is much richer in sugar than that of the portal. Cavazzani (*Pflüger's Archiv*, **57**, 181; *Centralbl. f. Physiol.*, **8**, No. 2) has shown that this might be due to stimulation of the sympathetic nerves, causing an increased decomposition of the hepatic glycogen. Other factors which tend to vitiate results are the influence of anæsthetics, the production of muscular struggling if no anæsthetics are given, and faulty methods of estimating sugar.

Accordingly in the present research the blood from the hepatic vein was collected by catheterisation through the jugular vein; the abdominal cavity was not opened at all, and arterial blood collected from the crural artery was used as the blood with which to compare the hepatic blood; the animals (dogs and sheep) had fasted for 24 hours before the operation; during the operation they were lightly morphinised.

In each experiment two portions of each kind of blood were collected: an interval of 10 minutes occurred between the collection of the samples; the second sample always showed an increased percentage of sugar. Coagulation of the blood was prevented by ammonium oxalate, proteïd was removed by the addition of metaphosphoric acid, and the sugar was estimated by Allihn's method. The mean of seven experiments gives:

Arterial blood contains 0·093 gram of sugar per 100 c.c.

Hepatic venous blood contains 0·107, or a plus of 0·014 per cent.; this figure is much smaller than Seegen's, but is, nevertheless, in favour of the glycogenic function of the liver, as taught by Bernard. The question as to whether sugar is the principal, or only, source of energy in the organism is not discussed. W. D. H.

Paralytic Intestinal Juice. By LAFAYETTE B. MENDEL (*Pflüger's Archiv*, 1896, **63**, 425—439).—The so-called paralytic intestinal juice is the secretion that occurs in the intestine after section of its nerves. The present experiments show that it is, nevertheless, a true secretion, and not, as some assume, a transudation from the blood. Its composition, especially as regards its alkalinity and percentage of chlorine, is similar to that of the normal juice as obtained by a fistula. Its small percentage of proteïd is against the transudation theory. Its action on food-stuffs is like that of the normal juice; histological examination of the mucous membrane shows no deviation from the normal. W. D. H.

Alterations in the Blood in Anæmia. By SOPHIE VON MORACZEWSKA (*Virchow's Archiv*, 1896, **144**, 127—158).—In pernicious anæmia, there is a great diminution of the alkalinity of the blood; this fluid has a high specific gravity, a small number of corpuscles—the red corpuscles are rich in pigment—and the blood has its total nitrogen increased. In chlorosis, the blood has a low alkalinity and a high specific gravity; the majority of red corpuscles are deficient in hæmoglobin.

In carcinoma, the blood has a high alkalinity, and a low specific gravity; the total dry residue is small, and the majority of red corpuscles are but feebly pigmented. W. D. H.

Excretion of Ammonia in Disease. By THEODOR RUMPF (*Virchow's Archiv*, 1896, **144**, 563—568).—Polemical. The author maintains the correctness of his views against those of Hallervorden (compare this vol., ii, 379). W. D. H.

Action of the Kidney in the Light of the Theory of Osmotic Pressure. By GUSTAV TAMMANN (*Zeit. physikal. Chem.*, 1896, **20**, 180—197).—The osmotic pressures of the various substances which are dissolved in the blood were estimated, and the author then considers the probable filtration action in the glomeruli. The view that in the glomerulus water alone is filtered off must be abandoned, since this would necessitate a blood pressure of over 7·7 atmos., whilst the actual difference of pressure between the blood in the looped veins and the liquid in the glomerulus capsule is probably only about 20 mm. The author considers it, therefore, most probable that all the soluble salts, &c., of the blood are filtered off, with the exception of albumin. The glomerulus filtrate is not, however, urine, and for its conversion requires a concentration of many salts, and especially of urea. This cannot be due to absorption of water by the blood, but how, and in what portions of the tubules, the changes take place, the author has not determined.

L. M. J.

Chemistry of Vegetable Physiology and Agriculture.

Cell-wall of Cotyledons of Lupinus luteus and Lupinus angustifolius. By ERNST SCHULZE (*Zeits. Physiol. Chem.*, 1896, **21**, 392—411).—The conclusions of Elfert (*Bibliotheca botanica*, 1894), Nadelmann (*Ber. d. Bot. Gesel.*, 1889, 248), and Tschirch (*Pflanzenanatomie*, **1**, 453) are not in accordance with the observations of E. Steiger and the author (Abstr., 1887, 440; 1889, 643, &c.), who have shown that the cell-wall of the cotyledons of *Lupinus luteus* and *L. angustifolius* contains a considerable proportion of a substance whose properties are quite distinct from those of ordinary cellulose, and to which they allude as paragalactan. Unlike cellulose, it dissolves readily in 1 per cent. hydrochloric or sulphuric acid, and, on hydrolysis, yields galactose and a pentose (probably arabinose), and no glucose; further, when oxidised by nitric acid, it gives mucic acid. These facts afford a basis for its approximate quantitative determination.

A definite number of shelled seeds of *L. luteus* or *L. angustifolius* were weighed, powdered, and extracted with water, dilute soda, alcohol, and ether, and the residual, insoluble, non-nitrogenous "paragalactan residue" dried and weighed; the latter was then hydrolysed by dilute sulphuric acid, and the glucose contained in aliquot portions of the solution was determined, a second portion being freed from sulphuric acid by means of barium carbonate, filtered, and evaporated, oxidised with nitric acid, and the mucic acid thus formed, collected and weighed. The cotyledons of embryos, of two or three weeks' growth, were then treated in a similar manner, and the results compared.

In the case of *L. angustifolius*, it was found that whilst the cotyledons of two-week-old seedlings yielded one-tenth of the quantity of glucose and one-twelfth of the amount of mucic acid afforded by the corresponding number of seeds, the cotyledons of three-week-old plants showed no further reduction in the amount of mucic acid obtainable, although the yield of glucose had considerably diminished. Estimations of the total insoluble non-nitrogenous matter showed that three-week-old cotyledons contained only about one-fourth of the amount present in the corresponding number of seeds. Similar results were obtained in the case of *L. luteus*.

From the above data it is clear that the portion of the "paragalactan residue" which gives mucic acid, diminished much more rapidly than that affording glucose, and that the diminution in the former is at an end in two weeks' time. This behaviour is in accordance with the belief, already expressed by the author, that the paragalactan is not a simple substance, but is made up of a galactan and an araban, the former being more rapidly utilised than the latter. The results afford conclusive evidence against the views of Elfert, Nadelmann, and Tschirch.

The author has compared the amounts of ordinary cellulose in the seed of *L. angustifolius*, and in the cotyledons after $2\frac{1}{2}$ weeks' growth, and has found them approximately equal. It is obvious, therefore, that the true cellulose is not absorbed in the initial stages of germination. A. L.

Decomposition and Assimilation of the Nitrogen Compounds of Stable Manure. By STEF. JENTYS (*Bied. Centr.*, 1896, **25**, 419; from *Bull. Acad. Sciences Cracovie*, 1893, 345; compare Abstr., 1894, ii, 110).—In fæces, there may be a rather considerable loss of nitrogen when decomposing under conditions of abundant aeration, without evolution of free nitrogen. Elimination of free nitrogen is independent of nitrification, and does not take place when solid excrement decomposes in absence of air. Loss of ammonia from decomposing fæces is very slight in presence of oxygen, and increased temperature and the presence of lime are then without effect; in absence of oxygen, there is abundant production of ammonia. In presence of urine, there is no increased production of ammonia from fæces; and the urine-ammonia is partly fixed by the products of the decomposing fæces, a portion of the ammonia so fixed being converted by microbes into stable compounds. Fresh horse dung supplies very little nitrogen to plants when buried in well aerated soil; but it remains to be seen how much the availability of the nitrogen of fæces can be increased by excluding oxygen. The assimilability of the nitrogen of dung which is kept in heaps is considerably diminished, as the available urine-nitrogen becomes converted into forms which are decomposed with difficulty, whilst the nitrogen of the fæces does not become more soluble. N. H. J. M.

Methods of determining the Availability of Organic Nitrogen in Fertilizers. By SAMUEL W. JOHNSON and EDWARD H. JENKINS (*Ann. Rep. Conn. Agric. Exper. Stat.*, 1894, No. 18, 73—112; compare *ibid.*, 1885, 115; 1886, 80; 1893, 218).—A number of pot experiments were made in which maize was grown in artificial soil (anthracite ashes and peat), supplied with the necessary minerals and with different amounts of nitrogen in the form of sodium nitrate, dried blood, fish, tankage, ground horn, cotton seed and linseed meals, castor pomace, and raw, roasted, and steamed leather. Soil extract was added to several pots with the view of supplying nitrifying organisms. The amount of produce and of nitrogen contained in it were determined. With regard to the effect of inoculation, the results indicate that, whether nitrification is essential or not to the utilisation of organic nitrogen, artificial inoculation was unnecessary under the conditions of the experiments. Comparing the availability of the nitrogen of the different manures used, and taking sodium nitrate as 100, the following numbers show the relative availability of nitrogen in the substances named: castor pomace (B) = 85; linseed meal = 80; blood = 77; cotton seed meal = 76; castor pomace (A) = 74; horn and hoof = 72; dry fish = 70; and tankage = 68 per cent. Finely powdered, raw leather was absolutely inert, and steamed and roasted leather was almost worthless. The nitrogen of leather which had been heated with sulphuric acid seemed to be as available as that of dried fish.

The solubility of the nitrogen of the same substances in pepsin solution was next determined. When the results are multiplied by 0·826 (which makes the figure obtained with dried blood the same as the figure obtained for the same substance in the vegetation experiments), the two sets of results agree fairly in most cases, so that the solubility of the nitrogen of these substances in pepsin solution is a fairly good indication of the relative availability of the nitrogen for the maize plant under the conditions of the experiments. With horn and hoof, steamed leather, and dissolved leather, the two sets of results were, however, totally different.

Finally, the amount of nitrogen rendered soluble during putrefaction (two and four weeks) was determined, but the results showed no satisfactory agreement, either with those obtained by the pot experiments or by solubility in pepsin solution. N. H. J. M.

Action of Vegetable Acids on Insoluble Phosphates in presence of Nitrates. By GUSTAV LOGES (*Bied. Centr.*, 1896, **25**, 366—

367; from *Verhandl. Ges. Deut. Naturforsch.*, 1896, 84).—When basic slag (2 grams) is treated with 2 per cent. hydrogen potassium oxalate solution (250 c.c.) for 48 hours, 27—47 per cent. of the total phosphoric acid is dissolved. Crude phosphates similarly treated give up 40—98 per cent. of the total phosphates. In presence of potassium nitrate (0·08—0·16 per cent.), the solubility of the phosphoric acid of basic slag is much increased (as much as from 28 to 68 per cent.), whilst with crude phosphates this is not the case. In basic slag, the particles of phosphate are encased in a strongly basic, calcareous substance, which is rendered insoluble by oxalic acid, and so protects the phosphate from the action of the acid. When a nitrate is present, nitric acid is liberated by the oxalic acid, and the calcium oxalate dissolved as nitrate. The same amount of nitric acid is alternately liberated and combined with lime, and the oxalic acid is thus enabled to reach the phosphate. Since in crude phosphates the calcareous covering does not exist, the presence of nitrate is without effect. Nitrate has also no effect when citric and tartaric acids are used as solvents for phosphoric acid. N. H. J. M.

Analytical Chemistry.

A Compensation Method in Gasometry. By CARL VON THAN (*Zeit. physikal. Chem.*, 1896, **20**, 307—320).—The author describes a form of eudiometer in which the corrections for temperature and pressure are eliminated. The principle of the method is the use of a similar tube containing a definite quantity of nitrogen which can be brought to either of four volumes, equal respectively to 1·25, 1·428, 2·0, and 5·0 times the normal volume. Arrangements are described for bringing the two tubes to the desired positions, so that the level of the mercury is the same in both, and corresponds with one of the observation marks in the compensation tube. Experiments are recorded indicating the accuracy of the instrument.

L. M. J.

Volumetric Estimation of Hydrofluoric acid. By KARL F. STAHL (*J. Amer. Chem. Soc.*, 1896, **18**, 415—425).—The strength of the commercial acid, if fairly pure, may be conveniently taken by means of a hydrometer made of platinum, but the following method is preferable.

Total acidity. Two grams of the sample is added to a measured volume of normal soda, allowing the liquid to remain faintly acid; after adding phenolphthaleïn and warming to 50°, the titration is completed.

Hydrofluosilicic acid. Two grams is diluted in a platinum dish with 5 c.c. of water, and partially neutralised with potassium carbonate, employing 0·05 gram for each c.c. of normal soda used in taking the total acidity; alcohol is now slowly added until the mixture contains 50 per cent. of it, and the whole is left for some time before the precipitate of potassium silicofluoride is collected; after washing it with 50 per cent. alcohol, the precipitate is put into a platinum dish, mixed with 25 c.c. of water, and titrated with normal soda. 1 mol. of potassium silicofluoride requires for neutralisation 4 mols. of sodium hydroxide; every 6 mols. of the latter correspond with 1 mol. of hydrofluosilicic acid.

Sulphuric acid. Four grams of the sample is evaporated in a platinum dish on the water bath until no more acid fumes are given off. The residue is then diluted with water and titrated with normal soda. L. DE K.

Estimation of Sulphur in Pyrites. By THOMAS S. GLADDING (*J. Amer. Chem. Soc.*, 1896, **18**, 446—449).—A controversy with Lunge (Abstr., 1895, ii, 411). The author again points out that if barium chloride is added all at once to a solution of a sulphate, the precipitated barium sulphate is strongly contaminated with the chloride. If, however, the barium solution is added drop by drop to the boiling solution and excess be avoided, the barium sulphate will be practically pure. L. DE K.

Detection of Nitrites by means of Cuprous Salts. By PAUL SABATIER (*Compt. rend.*, 1896, **122**, 1417—1419).—When a small quantity of a nitrite is dissolved in concentrated sulphuric acid, and a few particles of cuprous oxide are added, a very intense violet-purple coloration is produced. All cuprous salts produce the same result, although in the case of the dry chloride the coloured product forms slowly. With cuprous iodide, the iodine is liberated, but can be removed by means of chloroform, in which the purple compound is insoluble. Finely divided reduced copper dissolves in the sulphuric acid solution of the nitrite, giving the violet coloration; cupric salts show no similar reaction, nor do salts of many other metals.

The violet-purple solution loses its colour slowly, even in sealed tubes out of contact with air; the change is accelerated by heat, and takes place immediately if the liquid is agitated with air or if oxidising agents are added. Water, or sulphuric acid mixed with one-fifth its volume of water, also destroys the violet compound.

In order to apply this reaction to the detection of nitrites, a very small drop of the liquid is mixed on a porcelain plate with a drop of concentrated sulphuric acid, and a few particles of cuprous oxide are added. It is not so sensitive as the metaphenylenediamine reaction. C. H. B.

A Modified Ammonium Molybdate Solution. By A. L. WINTON (*J. Amer. Chem. Soc.*, 1896, **18**, 444—445).—One thousand grams of molybdic acid is dissolved in 4160 c.c. of a mixture of 1 part of ammonia (sp. gr. 0·90) and 2 parts of water. 5300 grams of ammonium nitrate is dissolved in a mixture of 6250 c.c. of nitric acid (sp. gr. 1·4) and 3090 c.c. of water, and the molybdate solution is added to it slowly with constant stirring. After a few days, the clear liquid is poured off for use.

This solution differs from Fresenius's solution in that it contains in 50 c.c. an extra 15 grams of ammonium nitrate. The author claims that the new solution causes a more rapid and complete formation of the yellow phosphoric acid precipitate. L. DE K.

A Simple Method for determining the Neutrality of the Ammonium Citrate Solution used in the Analysis of Fertilisers. By NATHANIEL W. LORD (*J. Amer. Chem. Soc.*, 1896, **18**, 456—457).—Pure litmus solution is added to 200 c.c. of distilled water until this is faintly coloured. Half of this is then diluted with its own volume of water; three clear 50 c.c. Nessler tubes are taken, and two are filled with the diluted liquid, and the third to the same depth with the stronger solution. To one of the two first, a drop of dilute sulphuric acid is added, and to the other, a drop of ammonia. These tubes are set one in front of the other, so that the light passes through both, thus giving a strictly neutral purple colour. To the liquid in the third tube is now added 5 c.c. of the citrate solution to be tested, and the colour is then compared with the colour shown by the doubled tubes. The slightest acidity or alkalinity is then at once noticed, and the amount of either acid or alkali necessary to make it neutral may be rapidly ascertained. L. DE K.

Separation of the Insoluble Phosphoric acid derived from Bone Phosphate from that derived from Mineral Phosphate. By A. P. BRYANT (*J. Amer. Chem. Soc.*, 1896, **18**, 491—498).—As the value of the phosphate insoluble in ammonium citrate is not the same in these two classes of phosphates, a method for separating and estimating them is desirable. The following separating solution is required:—75 grams of potassium iodide and 100 grams of mercuric iodide is dissolved in 350 c.c. of water and evaporated to a sp. gr. of 2·26. The liquid should be kept in a wash bottle.

The special apparatus required consists (1) of a separating tube, made of two tubes about 13 mm. internal diameter, one being 70 mm. in length, closed at one end, the other 200 mm. long, and open at both ends, and connected by a short piece of stout rubber tubing, sufficiently long to allow of the lower closed tube or "bucket" being separated by a screw pinch-cock from the upper portion. (2) An extraction tube, 25 mm. internal diameter, slightly contracted at one end, which has a rim, over which filter paper and cheese cloth can be tied.

In carrying out the separation, 2 grams of the sample is transferred to the extraction tube, and washed with 100—225 c.c. of hot water. After thoroughly drying, it is most carefully removed and transferred to the separating tube; 15—20 c.c. of the separating solution is then poured into the tube, thoroughly shaken, and the sides washed down with a jet of the solution. After five minutes, the lower part of the tube is tapped smartly with the finger to release any light portion carried down with the heavy, and the matter on the top is stirred up with a jet of solution. After the solution has cleared, the rubber tube is clamped, and a beaker is placed under the "bucket," which is then carefully removed, the fingers being protected by india-rubber finger tips. The solution in it containing the mineral phosphate is filtered into the supply flask, the first washings being again evaporated to a sp. gr. of 2·26, and the insoluble phosphoric acid is treated in the usual way. The light portion from the upper tube is treated in a similar manner. If desired, the heavy and light portions can be treated as for total phosphoric acid, thus determining all the phosphoric acid derived from inorganic and organic sources, except that soluble in water. L. DE K.

Rapid Estimation of Carbonic Anhydride in the Atmosphere, &c. By HENRIET (*Compt. rend.*, 1896, **123**, 125—127).—The method described makes use of the fact that a solution of normal potassium carbonate, coloured by a drop of phenolphthaleïn, becomes colourless on the addition of sulphuric acid, the instant the first trace of carbonic acid is set free after the neutral carbonate has become converted into the bicarbonate. The carbonic anhydride in a given volume of air is absorbed by potash and the liquid titrated, an equal volume of the original potash solution is also titrated, and the difference between the titrations multiplied by two gives the amount of carbonic anhydride absorbed. It is obvious that the amount of carbonate in the original potash need not be taken into account.

The apparatus suggested consists of a flask of about 6 litres capacity, fitted with a caoutchouc cork, through which pass a dropping funnel, and a tube bent at right angles and provided with a cock. A given volume of potash, coloured with phenolphthaleïn, and covered with a layer of ether to prevent the absorption of carbonic anhydride from the air, is run into the flask, containing the sample of air, by means of the dropping funnel; the latter is then thoroughly washed out with distilled water, previously boiled to remove carbonic anhydride, and the flask is agitated at intervals during one hour. The potash solution in the flask is then titrated. J. J. S.

Estimation of Potassium. By CHARLES FABRE (*Compt. rend.*, 1896, **122**, 1331—1333).—Potassium platinochloride, precipitated and washed in the usual way, is dissolved in hot water, and reduced to the metallic state by adding magnesium powder previously washed with alcohol and water. The chlorine in the liquid is estimated by means of silver nitrate solution, using potassium chromate as the indicator. A small quantity of insoluble magnesium oxychloride often forms during the reduction, and it is therefore advisable to add a few drops of sulphuric acid; after the reduction is complete, filter, neutralise with calcium carbonate, and then titrate. C. H. B.

The End Point in Gay-Lussac's Method of Silver Titration. By C. HOITSEMA (*Zeit. physikal. Chem.*, 1896, **20**, 272—282).—In the titration of silver by Gay-Lussac's method, the end point of the reaction is, according to Mulder, the "neutral point" at which both silver nitrate and sodium chloride produce a precipitate in the clear, supernatant liquid. The existence of this neutral point is explained by the author by the solubility of silver chloride. As the compound is also present in the solid state, the product of the concentrations of its ions must remain constant, and hence the addition of either silver or chlorine ions must cause a precipitation of the salt. From Stas's experiments on the sensitiveness of the reaction, the author calculates that in 100 c.c. 23×10^{-5} millimol is the least quantity capable of giving an observable precipitate, *i.e.*, about 1 part in 3,000,000, and from other experiments similar values are obtained. A similar neutral point is not observed in titrating with a bromide or iodide, because the solubility is less than the amount necessary to produce the apparent precipitate. L. M. J.

Solubility of Barium Sulphate. By FRIEDRICH W. KÜSTER (*Zeit. anorg. Chem.*, 1896, **12**, 261—271).—The author criticises the work of Fresenius and Hintz on the solubility of barium sulphate in water. These chemists found the solubility to be 1 in 100,000 parts of water. If, however, a solution of barium sulphate of this strength is prepared in the manner described by Fresenius and Hintz, and is then treated with pure barium sulphate, the electric resistance of the solution gradually decreases from 0·000085 to 0·000020, and then remains constant, and since the electric resistance is proportional to the concentration, it follows that this saturated solution of barium sulphate contains 1 in 425,000 parts. This number agrees closely with that obtained by Kohlrausch, Rose, and Holleman.

The author also criticises the work of Fresenius and Hintz on the solubility of barium sulphate in various salts and acids, and comes to the conclusion that the results obtained by them are only qualitative, and that the solubility varies in accordance with the action of mass, and the reciprocal influence of electrolytes on solution.

E. C. R.

Volumetric Estimation of Lead. By ANTONIO LONGI and L. BONAVIA (*Gazzetta*, 1896, **26**, i, 327—403).—The authors have carefully examined most of the methods suggested for determining lead volumetrically, in order to ascertain whether any of them possess sufficient accuracy to replace the ordinary gravimetric methods.

Trials were made of Domonte's process (*J. pr. Chem.*, 1846, **38**, 306), which consists in titrating a lead salt, dissolved in excess of potash, with sodium sulphide solution, and of Casamajor's modification of the method (Abstr., 1882, 776); the two methods are not to be recommended owing to the uncertainty of the end reaction.

Hempel's method (*Jahresb.*, 1853, 627) of determining lead by adding oxalic acid, separating the lead oxalate, and determining the oxalic acid either in the precipitate or in the solution by potassium permanganate, gives excellent results if certain precautions are taken. Considerable excess of oxalic acid must be added, and the solutions must be concentrated, lead oxalate being slightly soluble in water, but less so in oxalic acid solutions; the presence of even 0·066 per cent. of nitric acid interferes slightly with the determination of oxalic acid by permanganate. Alcohol should be added to the solution in which the precipitation is performed, and the precipitate should be washed with dilute alcohol, decomposed by sulphuric acid, and the oxalic acid titrated with permanganate.

Schwarz proposed (*Dingl. polyt. J.*, 1863, **169**, 284) to titrate lead solutions, in presence of sodium acetate, with potassium dichromate, determining the end of the titration by mixing drops of the supernatant liquid with silver nitrate solution. Notwithstanding Schwarz's statement to the contrary, the authors find that the precipitate of lead chromate does not settle with sufficient rapidity for volumetric work; they find also that freshly precipitated lead chromate reacts with silver nitrate giving silver chromate, so that the indication of the end of the titration may be masked. The method gives low results.

The process described by Pellet (this Journal, 1877, i, 227), depending on precipitating the lead with a chromate and determining the excess of the latter volumetrically, is in several respects unsound, and therefore gives bad results. The authors propose the following modification of Pellet's method: Sodium acetate solution is added to the concentrated lead solution, and then standard potassium dichromate is run in until the liquid becomes decidedly yellow; the solution is filtered, and the precipitate washed with the least possible quantity of water. The filtrate is conveniently diluted, and 2 parts of 100 c.c. taken; to each of these is added 5 c.c. of sulphuric acid, and then a standard solution of ferrous ammonium sulphate until the solution is green with no trace of the yellow tint of the chromate. The excess of ferrous salt is then titrated with permanganate, and the quantity of lead in the original solution calculated. The test results are very satisfactory.

Diehl's method (Abstr., 1880, 752), in which the excess of dichromate added to a lead solution is determined by sodium thiosulphate, cannot be depended on; the equation $4K_2Cr_2O_7 + 3Na_2S_2O_3 + 13H_2SO_4 = 3Na_2SO_4 + Cr_2(SO_4)_3 + 4K_2SO_4 + 13H_2O$, which Diehl uses, is incorrect, so that the equivalent values of the thiosulphate must be found by titration against the dichromate.

Roux (Abstr., 1881, 849) has devised a method for determining lead volumetrically, which is widely used; it consists in precipitating the lead by potassium dichromate in presence of sodium acetate, and estimating the excess of dichromate by standard ferrous ammonium sulphate, using potassium ferricyanide as an indicator. The authors failed to get trustworthy results with this method as it stands, but the results are much improved by acidifying the filtrate from the lead chromate with sulphuric acid and running it into a definite quantity of standard ferrous salt, until the latter gives no reaction with ferricyanide, or reducing the chromic acid by adding standard ferrous solution and estimating the excess of the latter by titration with standard dichromate; very dilute potassium ferricyanide strongly acidified with sulphuric acid should be used as an indicator. Very satisfactory results are obtained by this modified process in dilute lead nitrate solutions, which are neutral or contain free acetic acid; the solution, however, should not contain acetates.

The method of titrating chromates by adding potassium iodide and hydrochloric acid and estimating the liberated iodine with thiosulphate (Mohr, *Zeits. anal. Chem.*, 1863, **2**, 247) can be applied to the volumetric determination of lead; the titration with thiosulphate can be performed immediately after adding the hydrochloric acid. Sodium acetate is added to lead nitrate solution, and then excess of dichromate is run in; the lead chromate is filtered off, washed, and the filtrate made up to a standard volume, in which the excess of dichromate is determined by potassium iodide and thiosulphate. The chromic acid in the precipitate may also be determined by dissolving it in caustic potash, diluting to a known volume, adding potassium iodide, then hydrochloric acid, and estimating the liberated iodine with thiosulphate; the results are excellent, but N/100 potassium dichromate should be used, or the solution must be so dilute that the green colour of the chromic salt does not interfere with the end reaction (compare Crismer, Abstr., 1884, 1078).

The volumetric estimation of lead by titration with standard potassium ferrocyanide has been studied by Graeger (*Zeits. anal. Chem.*, 1865, **4**, 438) and Yvon (Abstr., 1889, 549). The authors add to a solution of lead nitrate not more than 3 per cent. of potassium nitrate, and then run in an excess of standard potassium ferrocyanide; the precipitate is filtered and washed with 3 per cent. potassium nitrate solution until the filtrate gives no reaction with ferric chloride. The ferrocyanide in the filtrate is determined by permanganate after acidification with sulphuric acid; the precipitated lead ferrocyanide, Pb_2FeCy_6, also may be dissolved in sulphuric acid and titrated with permanganate. Care must be taken to avoid atmospheric oxidation of the ferrocyanic solution, but otherwise the method is a practicable and accurate one.

The authors have made many trials of Haswell's method (*Dingl. polyt. J.*, 1881, **241**, 393), modifying it in various ways, but do not find it suitable for the volumetric estimation of lead. W. J. P.

Electrolytic Estimation of Iron, Nickel, and Zinc. By Hudson H. Nicholson and S. Avery (*J. Amer. Chem. Soc.*, 1896, **18**, 654—659).—Iron when deposited from an alkaline tartrate solution generally contains a trace of carbon, which compensates somewhat for the incomplete precipitation. When citric acid is used, the amount of carbon is still larger. Formates or oxalates do not deposit any carbon. The author has found that, when using Classen's well-known ammonium oxalate process, the electrolytic precipitation of the metal is much facilitated by the addition to the solution (150 c.c.) of a saturated solution of borax (5 c.c.). Nickel has no tendency to carry down with it any carbon, and its electrolytic estimation is, on the whole, satisfactory. As regards zinc, the authors got very satisfactory results in the presence of formic acid partially neutralised with sodium carbonate; a compact, well adhering, evenly distributed, and metallic looking deposit was obtained.

L. de K.

Sources of Error in Volhard's and similar Methods of Estimating Manganese in Steel. By George Auchy (*J. Amer. Chem. Soc.*, 1896, **18**, 498—511).—The author has made a large number of experiments on this process, and comes to the conclusion that the following are sources of error in Volhard's process.

(1) The incomplete neutralisation by zinc oxide, usually giving too high results. (2) The too sudden addition of the necessary excess of zinc, frequently giving results which are too low. (3) The titra-

tion in nitric acid solution, giving results about 0·01—0·02 per cent. too high. (4) Neutralisation by zinc oxide in hot solution, giving results which are too high.

In every case a blank experiment should be made, to ascertain the amount of manganese contained in the zinc oxide or other reagents.

The author prefers Stone's modification of Volhard's method as being easier and more rapid than the original. L. DE K.

Estimation of Lactose in Milk by double Dilution and Polarisation. By HARVEY W. WILEY and ERWIN E. EWELL (*J. Amer. Chem. Soc.*, 1896, **18**, 428—433).—The authors have endeavoured to determine the exact correction to be made for the volume occupied by the coagulum when clarifying the milk for polariscopic purposes.

Two portions of milk, of 65·82 grams each, are treated with 10 c.c. of solution of mercuric nitrate, prepared by dissolving the metal in twice its weight of nitric acid (sp. gr. 1·42), and diluting with 5 vols. of water. The one mixture is diluted to 100 c.c., the other to 200 c.c., and, after filtering, their respective rotations a and b are observed at 20°. The corrected rotation a' corresponding with a, allowance being made for the volume of the coagulum, is calculated from the equation $a' = \frac{ab}{a - b}$. The volume x of the precipitate is calculated from the equation $x = \frac{100(a - 2b)}{a - b}$. L. DE K.

Toxicological Examination for Mercuric Cyanide. By DIOSCORIDES VITALI (*L'Orosi*, 1896, **19**, 80—87).—Mercuric cyanide would not be detected by the ordinary toxicological methods for detecting cyanides, because it is not decomposed by the feeble acids, such as tartaric acid, used to liberate the hydrogen cyanide.

The author proposes to use a method of detecting mercuric cyanide based on the fact that this salt is converted by magnesium into magnesium cyanide, which, when heated in aqueous solution, is wholly decomposed into magnesia and hydrogen cyanide. The material to be investigated is put into a retort, mixed with the liquid which accompanies it or, in default of this, with water, and magnesium dust is added; the retort is then heated on the water bath and the vapours caused to pass through very dilute caustic soda. If it is permissible to evaporate the contents of the retort to dryness, all the hydrogen cyanide can be driven off, but, if this be inadvisable, dilute acetic acid may be added to drive off the last traces of hydrogen cyanide. W. J. P.

Analysis of Wool-grease. By FERDINAND ULZER and HEINRICH SEIDEL (*Zeit. angw. Chem.*, 1896, 349—350).—The authors recommend the following process: 20 grams of potassium hydroxide is dissolved in 20 c.c. of water contained in a hemispherical dish of about 350—500 c.c. capacity. The solution is heated to boiling, and 20 grams of melted wool-grease is introduced with vigorous stirring. After boiling for another minute, the dish is placed on the water bath until saponification seems complete; to make sure, however, the dish is placed for another two hours inside the water oven. The soap is then dissolved in 250 c.c. of boiling water, restoring from time to time the water lost by evaporation, and when completely dissolved 40 c.c. of hydrochloric acid, slightly diluted, is added. When the fatty mass is perfectly melted, it is, after cooling, removed, and then repeatedly boiled with water until the washings no longer show an acid reaction. After cooling, the fatty cake is removed, dried between blotting paper, and finally dried in the water oven. The total acidity number is then taken by means of Benedikt and Mangold's process. Three samples of Australian wool-grease gave, respectively, the figures 100·2, 102·9, and 101·9. Three South American samples gave the figures 96·4, 96·7, and 96·9.

To form an opinion on the genuineness of wool-grease, the authors also recommend taking the actual acidity number and the Reichert-Meissl number. Its iodine absorption may also be determined.

L. DE K.

A New Test for Asparagine. By L. MOULIN (*J. Pharm.*, 1896, **3**, 543).—"Saccharin," warmed with sulphuric acid and a little resorcinol, turns yellowish-green, and if water is now added, and the mixture neutralised with ammonia or aqueous soda, a strongly fluorescent liquid is obtained. The author has found that a similar fluorescence of a fine green tint is produced when asparagine is treated in this way. The same reaction is also given by a crystalline compound, which the author has separated from a cold infusion of liquorice by means of dialysis. L. DE K.

Test for Cinchona Alkaloïds. By JAWOROWSKI (*J. Pharm.*, 1896, **3**, 553; from *Pharm. Zeits. Russ.*, 1896, **6**).—A mixture is made of equal parts of a 10 per cent. solution of sodium thiosulphate and a 5 per cent. solution of copper sulphate, and at once added drop by drop to 5 c.c. of the liquid to be tested. In presence of quinine, quinidine, cinchonine or cinchonidine, a yellow, amorphous precipitate is formed; if no precipitate is formed after the lapse of a minute, quinine, &c., is absent; the reagent itself giving a precipitate after a time.

The reaction takes place not only in aqueous solutions, but also in solutions made with chloroform, ether, or amylic alcohol.

L. DE K.

Estimation of Caffeïne in Tea. By AUGUSTE PETIT and P. TERRAT (*J. Pharm.*, 1896, **3**, 529—534).—The authors have found that the use of magnesia or lime is superfluous, and that the alkaloïd may be completely extracted from tea by direct treatment with chloroform, provided the tea is moist; dry tea yielding but very little caffeïne to chloroform. The following method is recommended. 25 grams of powdered tea is treated with thrice its weight of boiling water and, after 15 minutes, the whole is evaporated on the water bath until the liquid has disappeared, but the residue remains still visibly moist. It is then introduced into a percolator and repeatedly exhausted with chloroform to extract the caffeïne. The chloroform is distilled off, and the residue taken up with boiling water, which, on evaporation, will generally yield a residue sufficiently pure to be at once weighed.

If the alkaloïd should be contaminated with chlorophyll, it must be treated with dilute sulphuric acid (1 : 10), filtered, neutralised with ammonia, and evaporated completely to dryness; the residue is then extracted with chloroform, and, after distilling off the latter, the pure caffeïne can be weighed. L. DE K.

Estimation of Nicotine and Ammonia in Tobacco. By VIKTOR VEDRÖDI (*Zeits. anal. Chem.*, 1896, **35**, 309—311).—A continuation of the controversy between the author and Kissling (see this vol., ii, 401). The author states that he used light petroleum and ethylic ether indifferently, having assured himself that the former "gave just as accurate results" as the latter. He reaffirms the fact of soda being carried over when Kissling's own apparatus is employed. The fact that the addition of ammonium chloride did not influence the nicotine titration when working in the manner he proposes (Abstr., 1895, ii, 541) he attributes to the complete volatilisation of the ammonia during the extraction with ether, the ether used being as free from water as possible, and the condenser being cooled with water of ordinary temperature.

With regard to the objection that the amido-compounds in tobacco would yield ammonia when boiled with soda, he considers that his experiments on this subject (Abstr., 1894, 371) show that the decomposition of proteïds by soda is too imperfect to influence the estimation of nicotine and ammonia in tobacco. Moreover, in the fermentation which occurs during the manufacture of tobacco from the leaves, most of the amido-compounds and proteïds are destroyed. With regard to the errors of calculation imputed to him by Kissling, he ranges his "practical" results against the "theoretical" arguments of the latter. M. J. S.

Distinction between Magenta and "Acid Magenta." By PAUL CAZENEUVE (*J. Pharm.*, 1896, **3**, 595—597).—A well-known and very delicate reaction for the presence of aldehydes in commercial alcohol is based on the violet colour produced when the sample is mixed with a solution of a rosaniline salt which has been previously decolorised by the addition of sulphurous acid.

The author points out that magenta and "acid magenta" do not behave in the same way. The article consisting of rosaniline hydrochloride gives the coloration, whereas the sulphonated (S) compound does not, a fact which has been overlooked by Lefèvre.

L. DE K.

Examination of Red Wines for Foreign Colouring Matters. By ALBIN BELAR (*Zeits. anal. Chem.*, 1896, **35**, 322—323).—Most of the coal tar dyes give coloured solutions with nitrobenzene, whilst the natural blue and red vegetable colours are insoluble. To make the test, about 5 c.c. of the wine is shaken in a test tube with an equal volume of pure nitrobenzene, first gently, then violently, and if an emulsion is produced it is caused to separate by warming. Rosaniline, purpurin, and safranine dissolve unchanged; methylene-blue is partially dissolved with an emerald-green coloration; eosin and rosolic acid both leave yellowish insoluble portions. Indigo carmine (sodium indigotindisulphonate) is quite insoluble. M. J. S.

Quantitative Separation of Proteïds in Beer Wort. By N. C. Henrik Schjerning (*Zeits. anal. Chem.*, 1896, **35**, 285—296).—The extended experience which the author has by this time acquired in the method of wort analysis suggested by him in 1894 (Abstr., 1894, ii, 371; and 1895, ii, 428) has enabled him to systematise and simplify the operations so as to form a process of practical value. Six reagents are now employed, namely, stannous chloride, lead acetate, acetic acid, uranium acetate, ferric acetate, and magnesium sulphate. The stannous chloride is prepared by dissolving 50 grams of tin in hydrochloric acid, evaporating to 130 grams, diluting to 1 litre, and rapidly filtering. It must be kept in small stoppered bottles. The lead acetate solution is approximately a 10 per cent. one, containing 10—12 drops of 45 per cent. acetic acid to the litre. The acetic acid is made by diluting 15 c.c. of the 45 per cent. acid to a litre. The uranium acetate solution is a cold saturated one, obtained by cooling and filtering one prepared at a higher temperature. "Scale" ferric acetate is preserved in the dry state, and dissolved just before use, taking always 0·8 gram to 40 c.c. of the above acetic acid diluted with 100 c.c. of water.

The stannous chloride precipitate, which is regarded as albumin, is obtained by adding 5 c.c. of the reagent to 25 c.c. of wort, allowing the mixture to repose for 4—6 hours at the ordinary temperature, collecting on an 11-cm. extracted filter, washing twice with cold water without suction, and estimating the nitrogen according to Kjeldahl's method. No correction for solubility is needed. Lead acetate precipitates the albumin and denucleïn; about 6 c.c. of the reagent is added to 25 c.c. of wort, the mixture heated to boiling, and the precipitate collected immediately and washed with cold water. In consequence of its solubility, a correction of 0·15 c.c. of N/10 acid must be applied for each 100 c.c. of filtrate + washings. For the ferric acetate precipitation, the reagent prepared as above is heated to boiling and mixed with 20 c.c. of wort. After boiling again, the precipitate is collected and washed with boiling water. No correction for solubility is required. The precipitate contains the albumin, denucleïn, and propeptone. The uranium precipitate contains the above proteïds together with the peptone; 20—25 c.c. of the reagent is added to 25 c.c. of wort, the mixture boiled, and then left to cool until next day in a dark place. The precipitate is washed with cold 1—2 per cent. uranium acetate solution; an addition of 0·1 c.c. of N/10 acid is made for each 100 c.c. of filtrate and washings. In cases where the ferric acetate precipitate is obtained with difficulty, the albumin and propeptone are thrown down by magnesium sulphate; 20 c.c. of the wort, mixed with 5 drops of 45 per cent. acetic acid, is warmed in a water bath to 36°, and 18—20 grams of pulverised crystalline magnesium sulphate is dissolved in it by stirring. It is then left at the ordinary temperature for $\frac{1}{2}$—1 hour, filtered, and the precipitate washed with a cold saturated solution of magnesium sulphate containing 4—5 grams of 45 per cent. acetic acid to the litre. Zinc sulphate gives identical results (see Bömer, this vol., ii, 83). An experiment made with the dialysed solution of the magnesium sulphate precipitate showed that the presence of saline substances was essential to the precipitation by stannous chloride and ferric acetate, and yielded, moreover, some anomalous results, which up to the present the author has not been able to interpret. M. J. S.

Estimation of Phosphorcarnic acid. By Balke and Ide (*Zeits. physiol. Chem.*, 1895, **21**, 380—386).—In estimating phosphorcarnic acid by precipitation as carniferrin (see Abstr., 1895, i, 313) the use of ferric chloride entails the possibility of dissolving some of the precipitate by excess of the reagent; and ferric ammonium alum cannot be employed, as the aqueous solution, when boiled, deposits a small quantity of insoluble nitrogenous matter. The following process is found to yield concordant results.

The dilute meat-extract is heated, to coagulate albumin, and filtered, the phosphates present being then precipitated with calcium chloride and ammonia. The filtrate is neutralised, heated to boiling, and mixed with a 1 per cent. solution of ferric chloride, the latter being carefully delivered from a burette; when a slight excess has been added, the whole is boiled for about two minutes, the addition of ferric chloride being discontinued if the excess be permanent; the liquid is then neutralised with a few drops of ammonia, and finally separated from the precipitate by decantation, the latter process being employed in washing the sediment. The total nitrogen in the dry carniferrin is then estimated and calculated as carnic acid.

A. L.

General and Physical Chemistry.

Optical Rotation of Stereoisomerides. By PAUL WALDEN (*Zeits. physikal. Chem.*, 1896, **20**, 377—388).—As the effect of constitution on the optical rotation of stereoisomeric compounds had not been previously investigated, the author has determined this constant in the case of a number of compounds which are derived from fumaric and maleïc acids. The numbers obtained are given in the accompanying table.

Compound.	Specific rotation.	Molecular rotation.	Mol. ref.	Mol. ref. calc.
Amylic maleate	+4·62°	11·82°	70·29	69·89
Amylic fumarate	+5·93	15·17	70·89	69·89
Amylic chloromaleate	+4·03	11·70	75·26	74·83
Amylic chlorofumarate	+5·78	16·78	75·53	74·83
Amylic bromomaleate	+4·58	15·36	81·02	77·76
Amylic bromofumarate	+5·99	20·07	80·00	77·76
Amylic citraconate	+4·14	11·17	75·11	74·49
Amylic mesaconate	+5·93	16·01	75·52	74·49
Amylic itaconate	+4·97	13·42	74·92	74·49
Maleinoïd amylic dimethylsuccinate	+3·42	9·79	79·08	79·48
Fumaroïd amylic dimethylsuccinate	+3·66	10·47	79·40	79·48
Amylic mesotartrate	+4·77	13·83	73·54	73·32
Amylic racemate	+3·37	9·77	73·26	73·32

The rotation of the itaconate was also observed after the compound had hardened to a glassy mass, probably owing to polymerisation, but the rotation was practically unaltered. It appears from these results, that in these isomerides, the fumaric derivatives have, on an average, a molecular rotation 4·5° greater than that of the maleïc derivatives. The molecular refraction (Lorenz formula) is greater than that calculated, the differences being greater in the fumaroïd compounds. (See Abstr., 1895, ii, 149; this vol., ii, 135, 137.) L. M. J.

Behaviour of Argon and Helium when submitted to the Electric Discharge. By J. NORMAN COLLIE and WILLIAM RAMSAY (*Proc. Roy. Soc.*, 1896, **59**, 257—270).—The experiments described fall into two classes: the first series relates to the distance through which electric sparks from an induction coil will strike through argon and through helium at atmospheric pressure, contrasted with the length of the spark gap in other gases, and also with the pressure at which the spark discharge changes into a ribbon-like discharge in different gases.

The second series, which was made with the object of determining how much of one gas is detectable in its mixture with another at different pressures, deals with the spectra of gases in electrodeless vacuum tubes.

In the first series, it was found that with argon the distance traversed by the spark is considerably greater than with air, oxygen, or hydrogen; whilst with helium, the spark is capable of passing through most unusual distances. Pure gases having been prepared, the results were:—Oxygen, 23·0 mm.; air, 33·0 mm.; hydrogen, 39·0 mm.; argon, 45·5 mm.; helium, probably 250—300 mm. The discharge in the case of helium was a ribbon of flame of a blue colour, not showing the yellow D_3 line very brightly.

It was then discovered that the spark discharge changes to a ribbon discharge at some definite pressure with all gases, and the following determinations were made.

Gas.	Pressure of changes of character of discharge.
Air	73 or 74 mm.
Hydrogen	42 or 43 ,,
Oxygen	81 ,,
Carbonic anhydride	92 or 94 ,,
Cyanogen	23 ,,
Nitrogen	33 ,,
Carbonic oxide	49 ,,
Helium	1270 ,,

Helium, therefore, presents a behaviour different from all other gases. In short, a tube like those termed "Plücker's tubes," need not be filled with helium at a low pressure, but exhibits all the phenomena of a vacuum tube at ordinary atmospheric pressure.

In the second series, experiments were performed with the view of ascertaining whether the spectrum affords an adequate test of the purity of gases.

The following table shows the quantities of different gases visible in the mixtures of them.

(1)	Helium in hydrogen,	33·0 per cent.	of helium invisible at 2·61 mm.
	,, ,,	10·0 per cent.	of helium barely visible at the lowest pressures.
(2)	Hydrogen in helium,	0·001 per cent.	of hydrogen visible at all pressures.
(3)	Nitrogen in helium,	0·01 per cent.	of nitrogen almost invisible.
(4)	Helium in nitrogen,	10·0 ,,	of helium difficult to detect.
(5)	Argon in helium,	0·06 ,,	still visible at all pressures.
(6)	Helium in argon,	33·0 ,,	invisible at 2·62 mm.
	,, ,,	25·0 ,,	,, 0·58 ,,
(7)	Nitrogen in argon,	0·42 ,,	,, 0·17 ,,
	,, ,,	0·08 ,,	,, 0·18 mm. although just visible at 1·05 mm.
(8)	Argon in nitrogen,	37·0 ,,	barely visible at any pressure.
(9)	Argon in oxygen,	2·3 ,,	difficult to distinguish at 1·04 mm.

The effect of oxygen is to greatly decrease the luminosity of the argon spectrum. The reduction of pressure has no effect in intensifying the spectrum. J. F. T.

Temperature Coefficient of the Electromotive Force of Silver Cells. By JOHAN M. LOVÉN (*Zeits. physikal. Chem.*, 1896, **20**, 456—460).—The energy relations in a galvanic chain are given by the equation $\pi\epsilon = E + \epsilon T . d\pi/dT$, where π is the E.M.F., ϵ the electricity developed, and E the total energy of the change. The temperature coefficient $d\pi/dT$ may therefore be either positive or negative according as the total energy is less or greater than the electrical energy. Measurements were made in the chain, silver | silver chloride in potassium chloride solution | potassium nitrate solution | silver nitrate solution | silver, and similar chains with bromide and iodide. The current and E.M.F. were determined, and also the heat of precipitation of silver chloride (which is the chemical change of the process), as well as the temperature coefficient, which was in each case found to be negative. The value for $\epsilon T . d\pi/dT$ agreed fairly well with the difference between the electrical energy, and the heat of precipitation, as indicated theoretically. L. M. J.

Sublimation Temperatures in the Cathode-Light Vacuum. By FRIEDRICH KRAFFT and H. WEILANDT (*Ber.*, 1896, **29**, 2240—2245; compare this vol., ii, 464).—In the former experiments, it was found that substances of high melting point no longer melt in the vacuum of the cathode-light, but directly sublime. The following sublimation points are given:—Anthracene, 103—104°; phenanthrene, 95—96°; chrysene, 169°; pyrogallol, 105—106°; caffeïne, 116°; alizarin, 153—155°; retene, 135°; salicylic acid, 75—76°; camphoric acid, 163—164°; theobromine, 156°. Antipyrine distils at 141—142°. Codeïne boils at 179°.

The alkaloïds were found to yield very pure products on distillation in the vacuum. Quinine boils at 170—180°; morphine at 191—193°. Indigo was found to sublime at 156—158° without decomposition; carbamide at 125°, and thiocarbamide at 98—99°. Uric acid did not sublime, but decomposed at 400°. J. F. T.

Solubility of Solids in Gases. By HENRYK ARCTOWSKI (*Zeits. anorg. Chem.*, 1896, **12**, 413—416).—The author considers that in order to test the validity of the laws of solubility, the simplest cases should be first studied, in which the effect of the solvent is reduced to a minimum. The solution of a solid in a gas appears to be such a case, and the sublimation of a solid may be regarded as a case of a purely physical solution. L. M. J.

Sublimation Velocity of Mercury Haloïd Salts. By HENRYK ARCTOWSKI (*Zeits. anorg. Chem.*, 1896, 417—426).—The velocities of sublimation of the halogen salts of mercury were determined by observing the loss of weight the salts experienced when kept at definite temperatures in a current of dry air. Mercuric chloride, bromide, and iodide, and mercurous chloride were examined, and curves constructed for temperature | loss of weight. The velocities of sublimation of the three mercuric salts decrease as the molecular weight increases, whilst that of mercurous chloride is considerably less than even that of mercuric iodide, indicating probably a higher molecular weight, and the formula Hg_2Cl_2, not HgCl. The curves for the three mercuric compounds closely resemble one another, differing only by a constant temperature difference, but the curve for calomel differs considerably from these. The velocity also appears to be dependent on the nature of the surface, and, for the same substance, decreases as the density increases. The velocities being measures of the vapour tension of the solid, may also be regarded as measures of the solubility of the solid in the gas (see preceding abstract).

L. M. J.

Sublimation Tension of Iodine. By HENRYK ARCTOWSKI (*Zeits. anorg. Chem.*, 1896, **12**, 427—430).—The sublimation tension of iodine at various temperatures has been previously determined at temperatures above 85°, and the author extends the observations to temperatures as low as 13° by measurement of the sublimation velocity. At 13°, this tension is only 0·1 mm. The velocity at a pressure of about 15 mm. was also determined, and, as expected, found to be considerably greater than at the ordinary atmospheric pressure.

L. M. J.

Determination of the Freezing Point of Dilute Aqueous Solutions. By A. PONSOT (*Compt. rend.*, 1896, **113**, 189—192).—The author discusses certain of the conditions under which the observed reduction of the freezing point of dilute solutions accurately represents the true reduction, having regard to the effects of the concentration of the solution, superfusion, the rate of cooling, and the velocity of the agitator. The general conclusion is that the most accurate result is obtained when the value of the rate of cooling (V_1) is zero (compare Abstr., 1894, ii, 342).

C. H. B.

Influence of Chemical Affinity on Solubility. By ST. TOLLOCZKO (*Zeit. physikal. Chem.*, 1896, **20**, 412—416).—Although the two components of a racemate show identical chemical properties, it was considered possible that a difference in solubility might exist if the solvent were itself an active compound. To determine whether this was so, a racemate was obtained in solution equilibrium with water and an active solvent, and then the solutions examined optically, to test for excess of either constituent. In the first case, racemic acid was used, the solvents being water and lævo-amylic alcohol, and in the second case mandelic acid, with ether and an aqueous solution of levulose. In both cases negative results were obtained, no excess of either active constituent entering into either solvent.

L. M. J.

The Lowering of Solubility. By ST. TOLLOCZKO (*Zeits. physikal. Chem.*, 1896, **20**, 389—412).—According to Nernst's law (Abstr., 1890, 1368), the relative lowering of the solubility of a solvent in a second liquid caused by the addition of a foreign substance is equal to the ratio of the number of dissolved molecules of the foreign substance to the number of molecules of the solvent.* The author endeavoured to prove the law by determining the effect of various organic compounds, insoluble in water, on the solubility of ethylic ether in water. The expression has to be somewhat altered, owing to the solubility of water in the ether, and an expression allowing for this is deduced. The experimental details are recorded, and the results for the molecular weight, calculated on the assumption of the law, are given in the accompanying table, in which the concentration is given in grams per 100 grams of pure ether, and the highest and lowest concentrations alone are recorded.

	Concentration 1.	Concentration 2.	Mol. wt. (1).	Mol. wt. (2).
Benzene	1·77	13·3	81·0	83·0
Toluene	1·77	13·25	87·0	85·0
Xylene	1·67	18·0	103·0	110·0
ψ-Cumene	2·98	—	116·0	—
Diamylene	1·15	20·3	134·0	149·0
Thymol	1·75	23·25	135·0	133·0
Borneol	1·93	4·17	139·0	156·0
Menthol	1·30	21·15	140·0	156·0
Chloroform	1·10	20·15	109·5	122·5
Carbon bisulphide	11·27	—	85·0	—

The results prove the validity of the law and its use for the determination of molecular weights, even at comparatively high concentrations. The solubility of ether was also determined at numerous temperatures, the value in grams of ether per gram of water being: 13°, 0·08930; 15°, 0·08399; 17°, 0·07955; 19°, 0·07494; 21°, 0·06948. The experiments also indicate the great effect of small quantities of impurities if the ether is only in small excess, the true values being only obtained when the excess of ether is great. L. M. J.

Influence of Pressure on Solubility. By ED. VON STACKELBERG (*Zeits. physikal. Chem.*, 1896, **20**, 337—358).—The author first investigates theoretically from the thermodynamical standpoint, expressions for the effect of pressure on solubility. A relation connecting the pressure and temperature effects is first established, and then a formula is deduced, which is independent of the temperature coefficient. By means of a Cailletet's pump, saturated solutions of sodium chloride, alum, and ammonium chloride were obtained at a pressure of 500 atmos., and small quantities were withdrawn and analysed. The pressure coefficients were hence obtained, and compared with those deduced theoretically. The results obtained for the three salts are as follows, the value d/x being the increase in milligrams per gram of solution for 100 atmos.

Salt.	d/x found.	d/x calc.
Sodium chloride	+1·2	+3·2
Ammonium chloride	−2·8	−3·7; −2·5
Alum	+6·7	+13·2

L. M. J.

Etherification. By HEINRICH GOLDSCHMIDT (*Ber.*, 1896, **29**, 2208—2216).—The author, having previously suggested (this vol., i, 229) that the acceleration of the speed of etherification which occurs on adding a strong acid to an alcoholic solution of an acid is due to the presence of hydrogen ions, now brings further evidence in support of his view. If the speed of etherification be dependent on the extent to which the catalysing acid is dissociated, the addition of a salt of the latter should bring about a decrease in the velocity of etherification. It is found that, by adding paratoluidine picrate to an alcoholic solution of phenylacetic acid, picric acid being also added to serve as a catalyst, etherification is greatly retarded; the speed of etherification decreases as the quantity of paratoluidine picrate added is increased. The velocity constant k, calculated from the equation representing a monomolecular reaction, such as that supposed to occur during etherification, decreases gradually as the time increases, the decrease being much less in the experiments in which paratoluidine picrate is used than in those in which no salt is added. In the case of the latter, the decrease is caused by the water continually produced, but the retarding effect of the water is partially compensated when toluidine picrate is present, because the water partially decomposes the salt and so increases the available quantity of free acid.

An alcoholic solution of trichloracetic acid slowly changes into ethylic trichloracetate at ordinary temperatures; the author has studied the rate of change at 25°, and finds that, considering the reaction as a monomolecular one, the constant k decreases continuously with the time. The constant k decreases very slowly if the action be calculated as a bimolecular one, so that the etherification must, in this case, be the result of autocatalytic action, the reaction between the acid and alcohol being due to the presence of hydrogen ions resulting from the dissociation of the acid. The same result is obtained on recalculating Petersen's numbers (Abstr., 1895, ii, 258) representing the velocity of etherification of formic acid dissolved in methylic alcohol.

It follows that etherification occurring, with or without the addition of a catalysing acid, is primarily caused by the activity of the hydrogen ions present, so that the various theories premising intermediate stages of the reaction in etherification are now unnecessary.

W. J. P.

Indirect Etherification. By EMIL PETERSEN (*Zeits. physikal. Chem.*, 1896, **20**, 331—333).—The author considers that, although Tafel's explanation regarding the action of small quantities of hydrogen chloride in "indirect etherification" (this vol., ii, 470) is probably correct, it does not vitiate the availability of the method in those cases where it is desirable (Abstr., 1895, ii, 258). L. M. J.

Relation between the Colours of Atom, Ion, and Molecule. II. By M. Carey Lea (*Zeits. anorg. Chem.*, **12**, 340—352; compare Abstr., 1895, ii, 441; this vol., ii, 594).—(1) Coloured inorganic substances composed of colourless ions yield colourless solutions; for example, take the colourless solutions of mercuric iodide in alcohol, and of antimony pentasulphide in alkaline sulphide solutions. This shows that in solution the ions are so far separated that their vibrations do not mutually influence each other. (2) There is no relation between the colour of a molecule and those of its constituent ions. Two colourless ions may give a coloured molecule, as in the case of bromine, and of silver sulphide; and coloured ions may give a colourless molecule, as in the case of the white metal nickel, the ions of which are green, or a molecule of a different colour, as in the case of red copper, the ions of which are blue. (3) The change of colour of the indicators used in acidimetry is not due to dissociation, for the colour of the alkaline solution, in which the dissociated sodium salt of the colour acid is supposed to exist, persists after the water has been evaporated off, and the possibility of dissociation thus removed. (4) The systems of arrangement of the elements proposed by Thomsen (Abstr., 1895, ii, 491; this vol., ii, 16) and de Boisbaudran (Abstr., 1895, ii, 440) have much in common with that of the author (Abstr., 1895, ii, 441). (5) The ions are not absolutely free in solution, but are subject to some kind of mutual restriction; for example, the chlorine ions of hydrochloric acid are unable to convert the ferrous ions of a solution of ferrous chloride into ferric ions until the hydrogen ions, by which they are accompanied, are removed by an oxidising agent. C. F. B.

The Origin of Dalton's Atomic Theory. By Heinrich Debus (*Zeit. physikal. Chem.*, 1896, **20**, 359—376).—The author contests several conclusions of Roscoe and Harden, published in the *New Views of Dalton's Atomic Theory*. He sums up his own conclusions as follows. (1) That in 1801, Dalton, from physical considerations, was led to the hypothesis that equal volumes of gases under normal conditions contain equal numbers of molecules, that is, $M/d = k$. (2) That it is highly probable that this hypothesis, together with his observations on the oxides of nitrogen, led him to formulate his atomic theory. (3) Atomic views led Dalton, in 1805, to abandon his hypothesis $M/d = k$. (4) Avogadro was probably aware of Dalton's views, and borrowed his hypothesis. L. M. J.

Twin-Elements. By Richard Lorenz (*Zeits. anorg. Chem.*, **12**, 329—339).—The following 14 pairs of twins are said to exist among the elements, by twins being understood two elements with generally similar properties, and of which the atomic weights do not differ by more than 1·4 (usually about 1): B-C, Na-Mg, Al-Si, P-S, K-Ca, V-Cr, Mn-Fe, Ni-Co, Se-Br, Pd-Ag, Sn-Sb, I-Te, Ta-W, Pb-Bi.

It is also noticed that the atomic weight of a member of one twin pair differs from that of the corresponding member of the next twin pair by some multiple of 4 (the atomic weights being taken to the nearest integer), and that the other elements, which do not form pairs, also obey this law, so that these elements may be taken each as representing a twin pair, the other member of which is not known; exceptions are H, Be, N, Zn, Ga, Rb, Y, Zr, Nb, In, Cs, Ba, Ir, Au, and certain rare-earth metals, the atomic weights of which have not as yet been accurately determined. It is pointed out that, according to this system, tellurium should have a greater atomic weight than iodine, which is in accordance with the latest determinations. C. F. B.

Simple Method of Reducing Weight in Air to Weight in a Vacuum. By Fritz Salomon (*Zeit. angw. Chem.*, 1896, 529—531).—The author calls attention to the fact that chemists generally neglect to convert weight in air into weight in a vacuum, and describes a modification, suitable for placing in a balance case, of his "barothermometer" (*Zeit. angw. Chem.*, 1893 and 1894), an instrument which shows the weight of a litre of air at the atmospheric temperature and pressure at the time of observation. L. de K.

Inorganic Chemistry.

Atomic Weights of Oxygen and Hydrogen. By Edward W. Morley (*Zeits. physikal. Chem.*, 1896, **20**, 417—455).—The densities of the two gases having been previously determined (this vol., ii, 518 and 595), the question of the atomic weights was next considered.

The first method was similar to that of Leduc (Abstr., 1892, 1388), that is, was dependent on the determination of the density of the mixed gases evolved by the electrolysis of an alkaline solution. One point observed in the researches was the capability which air possesses of creeping between the mercury and the glass into the eudiometer if the mercury is not covered by a layer of sulphuric acid. In all the analyses of the electrolytic gas, the hydrogen was found to be present in slight excess, the average for the series being 0·000293 (= excess / total gas). This has to be allowed for in the calculation, and was probably overlooked by Leduc. The density of the mixed gases was thus obtained as $D = 0{\cdot}535510 \pm 0{\cdot}000010$ (gram / litre). The ratios of the volumes of oxygen and hydrogen in the mixture were then calculated on the assumption of Van der Waals' equation, and found to be 1 : 2·00357, yielding the ratio for the combined volumes = 1 : 2·00269.

The second method was by means of the synthesis of water by the combination of weighed quantities of the gases. The oxygen was weighed as in the density determinations, and the hydrogen by the loss of a charged palladium tube, and the uncombined residue was in all cases eudiometrically analysed. The mean value for the ratio of the atomic weights obtained from the weights of the two gases was 15·8792, and from the weights of hydrogen and water 15·8785, whilst that calculated by the first method is also 15·879, which is, moreover, the mean value of the results of Dittmar and Henderson (15·866, 15·868), Cooke and Richards (15·869), Leduc (15·881), Rayleigh (15·89), and Noyes (15·897). The value O = 15·879 is hence at present the most probable value for the atomic weight. L. M. J.

Replacement of the Chlorine in Chlorides of Non-Metals and Metalloids by Bromine and Iodine. By H. Lloyd Snape (*Chem. News*, 1896, **74**, 27—29).—In many experiments, various non-metallic chlorides were heated in sealed glass tubes in a paraffin bath with excess of the metallic haloïd salt, the objects being to heat the dry materials out of contact with the air, to watch for any decomposition and to adjust the temperature accordingly, and to avoid inconvenience arising from the presence of any undecomposed non-metallic chloride in the final product. In this way, with potassium bromide, phosphorus trichloride was apparently unchanged at 200—220°, carbon tetrachloride (like silicon tetrachloride) was but little attacked at 200°, whereas sulphur monochloride at 200—220° and arsenic trichloride at 180—220° were partially converted into bromides. With potassium iodide, both sulphur monochloride and carbon tetrachloride were more completely decomposed, the former even at ordinary temperatures, the latter at 200°, but yielded only mixtures of sulphur and iodine, and carbon and iodine respectively, whilst phosphorus trichloride at 200°, arsenic trichloride at 240°, and antimony chloride at 200° were readily converted into their iodides. A repetition of Guthrie's experiment with sulphur monochloride and ethylic iodide also yielded a mixture of sulphur and iodine. Antimony trichloride too could be converted into antimony tribromide by passing the vapour over a long layer of potassium bromide heated to a temperature sufficiently high to decompose the double salt. D. A. L.

Nitrosodisulphonic acid and its Salts. By Paul Sabatier (*Compt. rend.*, 1896, **123**, 255—258).—A solution of nitrososulphonic acid or sodium nitrite in sulphuric acid is reduced not only by cuprous and ferrous salts (this vol., ii, 599, 622), but also by a large number of other substances, with production of the blue nitrosodisulphonic acid. Mercury acts very rapidly, but also readily decomposes the nitrosodisulphonic acid. Finely divided silver, tin, and aluminium behave in the same way, and so also do cadmium, antimony, and lead, although much more slowly. Zinc, even in powder, bismuth, chromium, uranium, sulphur, phosphorus, nickel, arsenic, thallium, and magnesium react more or less readily, but do not produce the blue compound. Selenium and tellurium behave as with sulphuric acid alone. Arsenious anhydride, antimonious, manganous, and stannous oxides, mercurous and chromous chlorides, carbon bisulphide, and arsenic, bismuth, tin, and zinc sulphides, potassium ferrocyanide, carbamide, and oxalic, tartaric, and citric acids give no distinct result. On the other hand, the blue product is readily produced by zinc phosphide or arsenide, and by barium hypophosphite, less readily by lead sulphide and stannous chloride. Alcohol, ether, glycerol, and even acetic acid will produce a blue ring if added to the nitrososulphonic acid solution.

The salts are more stable than the acid (*loc. cit.*), and if a cupric salt or a ferric salt is dissolved in the nitrososulphonic acid solution, and the reducing agents are then allowed to act, the colour produced is much more intense, and it is observed with substances such as arsenic and zinc sulphides, bismuth, zinc powder, &c., which do not seem to act under ordinary conditions.

Sulphurous anhydride reduces the nitrosulphonic acid only in presence of water. The blue compound is formed, for instance, if sulphurous anhydride is dissolved in sulphuric acid diluted with one-third of its volume of water, and this liquid is added to an equal volume of the nitrosulphonic acid solution. The copper salt is formed by adding copper nitrite to a solution of sulphurous anhydride in sulphuric acid containing a small quantity of water.

When nitric oxide is passed into a solution of cupric sulphate in sulphuric acid, the blue compound is formed as Desbassins and Richmond have observed. Nitrosulphonic acid is formed as well as cupric nitrosodisulphonate, $3NO + CuSO_4 + H_2SO_4 = NO(SO_3)_2Cu + 2NO_2SO_3H + 2H_2O$, and on adding a cuprous salt a further quantity of the cupric nitrosodisulphonate is produced. Ferric sulphate behaves like cupric sulphate. The red-violet compound is produced still more readily when the nitric oxide is passed into a solution of ferrous sulphate in sulphuric acid, part of the ferrous salt being oxidised. The nitric oxide has no action on sulphuric acid alone, nor on solutions of chromic or manganic sulphate in the acid.

C. H. B.

Preparation of Selenic acid. By R. Metzner (*Compt. rend.*, 1895, **123**, 236—238).—When excess of potassium permanganate is added to a solution of selenious acid, complete oxidation takes place, the products being selenic acid and potassium selenate, which remain in solution, and manganese sesquioxide, which is completely precipitated if the solutions are dilute. After removal of the manganese oxide, the potassium can be precipitated by means of hydrofluosilicic acid.

A better method is to employ permanganic acid, obtained from pure barium permanganate. The solutions should be dilute, and it is best to add the selenious acid to the permanganic acid. After removal of the manganese oxide and concentration of the wash water, a small quantity of permanganic acid is added to oxidise the trace of selenious acid that remains and to precipitate a small quantity of manganese that has dissolved. Sometimes it is necessary to heat the liquid to boiling, but the manganese oxide separates immediately on the addition of a drop of selenious acid solution. Finally permanganic acid is added until the liquid shows a persistent pink tinge in a column 20 cm. thick, and the liquid is concentrated, preferably under reduced pressure. An acid can be obtained, which corresponds almost exactly with the composition H_2SeO_4. C. H. B.

Metallic Compounds of Triphosphoric acid. By MARTIN STANGE (*Zeits. anorg. Chem.*, 1896, **12**, 444—463).—Sodium triphosphate, $Na_5P_3O_{10} + 8H_2O$, is obtained by heating sodium pyrophosphate with sodium metaphosphate, or better, sodium pyrophosphate (111·8 parts) with phosphate (73·1 parts) at a bright red heat for 20—30 minutes. The melt becomes warm when dissolved in water, and part of the triphosphate is decomposed into pyro- and meta-phosphates. The salt is obtained pure by adding water to the mother liquors of the melt, which solidify on cooling, and either separating the salt by filtration or by spreading it on a porous plate. The product is a fine powder consisting of four-sided leaflets, and is quite free from metaphosphoric acid. It is decomposed by heat, acids, and bases, as already described by Schwarz (Abstr., 1895, ii, 445). When treated with strong ammonia, it forms a white emulsion, and then an oil is precipitated, which is a concentrated solution of metaphosphate. Schwarz states that orthophosphate is formed by the action of ammonia; but the author was unable to obtain orthophosphate even by boiling the mixture.

The properties of cobalt, nickel, and zinc triphosphates, $CoNa_3P_3O_{10} + 12H_2O$; $Zn_2NaP_3O_{10} + 9\frac{1}{2}H_2O$, have already been described by Schwarz. He obtained the cobalt and nickel salts, however, only after the mixture had been allowed to remain some time; a similar result was obtained by the author when working with sodium triphosphate containing metaphosphate, but when pure materials were used, a precipitate was at once formed.

Ferrotrisodium triphosphate, $FeNa_3P_3O_{10} + 11\frac{1}{2}H_2O$, is obtained by adding sodium triphosphate to a solution of ferrous sulphate. The solution, after filtration, deposits the salt in slender, silky, white needles. It is stable when dry, but in contact with water rapidly oxidises and forms a brown syrup, which probably consists of a basic salt. It dissolves in nitric acid, and, on warming, is converted into ferric pyrophosphate with a very violent evolution of nitric oxide. It is dehydrated only by heating to the melting point, and ferrous oxide is then deposited. The author was unable to obtain the corresponding ferric salt, probably because it is very easily soluble in water, and thereby undergoes decomposition.

Magnesium trisodium triphosphate, $MgNa_3P_3O_{10} + 13H_2O$, is obtained by adding a solution of magnesium chloride to one of sodium triphosphate until a permanent precipitate begins to form; this is quickly redissolved by the addition of sufficient triphosphate, and the salt then at once commences to separate. It crystallises in very slender needles, is decomposed by exposure to air, losing water of crystallisation, and, when heated, intumesces like borax, and melts at a red heat to a clear glass easily soluble in acids.

Manganese trisodium triphosphate, $MnNa_3P_3O_{10} + 12H_2O$, is obtained by mixing a solution of manganese sulphate with sodium triphosphate. It crystallises in slender, white prisms, loses its water of crystallisation only when heated to redness, and then melts to a colourless glass which is easily soluble in sulphuric acid.

Tricopper sodium pyrophosphate, $Cu_3Na_2P_4O_{14} + 10H_2O$, is obtained by mixing a solution of sodium triphosphate with copper sulphate until a permanent precipitate is obtained. It is a white, crystalline powder, quite insoluble in water, and when heated becomes blue, green, then yellowish-green, and sinters at a high temperature. Even after heating, it is soluble in nitric and hydrochloric acids.

Cupric trisodium triphosphate, $CuNa_3P_3O_{10} + 12H_2O$, is obtained by mixing sodium triphosphate and copper sulphate in the theoretical proportions. It crystallises from the solution, after 1 to 2 days, in lustrous, bluish-green prisms. When heated, it melts in its water of crystallisation, and at a red heat is converted into a glass which, when hot, is yellow, when cold, bluish-green, and is easily dissolved by acids.

Lead triphosphate-sodium pyrophosphate, $Pb_5Na_4P_8O_{27} + 10H_2O$, is obtained by adding a neutral solution of lead nitrate to a solution of sodium triphosphate until a permanent precipitate is produced, and then dissolving the latter by the addition of more triphosphate. It crystallises in yellowish nodules, and melts, when heated, to a colourless glass, which is easily soluble in nitric acid. An amorphous lead salt is obtained by employing an excess of lead nitrate; it has not, however, a constant composition, and contains sodium which cannot be eliminated by prolonged washing. When the salts are allowed to react with one another for some time, the analysis of the product approaches that of lead triphosphate. From dilute solution, however, and when the precipitate is at once separated, the product appears to be lead pyrophosphate contaminated with metaphosphate. The filtrate from the precipitate contains lead and phosphoric acid, so that apparently an excess of lead salt decomposes the triphosphate.

Trisilver sodium pyrophosphate.—The action of silver nitrate on sodium triphosphate is very similar to that of lead nitrate, and complicated pyrophosphates are obtained, which the author was unable to isolate. A salt of the composition $Ag_3NaP_2O_7 + \frac{1}{2}H_2O$, which is probably formed in the above reaction, is obtained by treating a saturated solution of sodium pyrophosphate with silver nitrate, when it is precipitated as a heavy, crystalline powder, together with amorphous silver pyrophosphate. When strongly heated, it melts to a brown liquid, which, on cooling, forms a lemon-yellow, crystalline mass containing orthophosphate.

Chromium salts give no precipitate with triphosphate, but with a mixture of molecular proportions of meta- and pyro-phosphates, a green precipitate is obtained. With manganese salts, triphosphates yield a crystalline precipitate of triphosphate, whilst with the mixed phosphates an amorphous precipitate is formed, and only after remaining some weeks, a small quantity of crystalline manganese trisodium triphosphate. Cadmium salts give no precipitate with a solution of triphosphate, and with a solution of the mixed phosphates, a precipitate of small crystals. From the above results, the author concludes that the triphosphates are chemical compounds, and not double salts of pyro- with meta-phosphoric acid. E. C. R.

Artificial Production of Diamonds. By HENRI MOISSAN (*Compt. rend.*, 1896, **123**, 206—210).—Iron was carburetted and fused in the electric furnace and allowed to fall into mercury 10 cm.

deep covered with water 20 cm.deep. The irregular shaped granules thus obtained were saturated with carbon, but contained none of high sp. gr.; the spheres or ellipsoids formed at the same time contained, however, both black diamonds and transparent diamonds, some of which, although microscopic, showed remarkable regularity of crystalline form.

Larger masses of the fused carburetted iron were allowed to fall into water and mercury at the bottom of a pit shaft 32 metres deep, but the conditions of the experiment were not favourable to the production of spherical masses of iron. It was observed that when the falling globules touched the tub containing the mercury, or came in contact with the earth they broke up, with a flame, into scintillating globules, the change being accompanied by a report like that of a rifle. It was also observed that even during the short time occupied by the fall, the temperature of the globules was materially reduced.

In other experiments, the fused carburetted iron was run into a small cylindrical cavity in a large mass of iron or copper. Under these conditions, the fused metal is very rapidly cooled, and diamonds are obtained mixed with graphite, but the yield is not very satisfactory. C. H. B.

Black Diamonds. By HENRI MOISSAN (*Compt. rend.*, 1896, **123**, 210—211).—The black matter, or so-called black diamond, included in transparent diamonds from Brazil, is composed of a variety of carbon different from diamond. When such diamonds are powdered and heated in oxygen at a temperature 200° below the ignition point of the diamond, the black matter burns away with production of carbonic anhydride, and the residual diamond is quite white.

C. H. B.

Homogeneity of Argon and Helium. By WILLIAM RAMSAY and J. NORMAN COLLIE (*Compt. rend.*, 1896, **123**, 214—216, and also *Nature*, 1896, **54**, 546).—In each case the gas was allowed to diffuse through a small tube of porous earthenware into a vacuum, and was submitted to several successive fractionations in this way. Direct experiment showed that the process permits of the separation of helium from hydrogen, and carbonic anhydride from oxygen, and that by observing the rate of descent of a column of mercury connected with the apparatus, a fairly accurate determination of the sp. gr. of a gas may be made.

In the case of argon, several fractionations resulted in two portions of the gas being obtained of sp. gr. 19·93 and 20·01 respectively, and it follows that little or no separation is effected.

In the case of helium, on the other hand, the gas was separated into two portions of sp. gr. 1·874 and 2·133 respectively, and repeated fractionation of each of these portions failed to alter these figures. Determinations of the refractive indices of the two gases by Lord Rayleigh gave for the lighter 0·1350 (air = 1), and for the heavier 0·1524, the two values being almost exactly proportional to the sp. gr. of the gases. Both fractions of helium gave absolutely the same spectrum. It is, therefore, impossible to say that one fraction is a mixture, whilst the other is homogeneous.

Having regard to the fact that the spectra of the two gases are identical, that the refractive indices of known gases of different chemical composition are not proportional to their sp. gr., and that it is improbable that there should be two different gases with nearly the same sp. gr., the authors suggest that in their experiments they may have separated light molecules of helium from heavy molecules of helium. C. H. B.

Quick Nitrogen Absorbent for the Liberation of Argon and the Manufacture of Metallic Lithium. By Henry N. Warren (*Chem. News*, 1896, **74**, 6).—Dry lithium hydroxide is heated in a tubulated iron retort, metallic magnesium being added in small pieces from time to time through the tubulure; metallic lithium distils over. The carbonate may be used, but then the metal is contaminated with carbide, which evolves acetylene in contact with water.

A material which absorbs nitrogen with great avidity is obtained by the reduction, in an atmosphere of hydrogen at as low a temperature as possible, of a mixture of magnesium powder with calcium or barium hydroxide, saturated with a strong solution of lithia. D. A. L.

Alloys. By Henri Gautier (*Compt. rend.*, 1896, **123**, 172—174).—The author has determined the melting points of a number of alloys with the object of ascertaining whether there is a group of alloys containing two metals which are not isomorphous, but which form an alloy isomorphous with one of them, and are, therefore, analogous to ammonium ferric chloride, sodium silver chloride, or calcium sodium sulphate. In the following table, the compositions of the alloys are given in per cents. of the less fusible constituent.

Cd–Ag.	M. p.	Zn–Ag.	M. p.	Sn–Ag.	M. p.	Sb–Ag.	M. p.	Cu–Ni.	M. p.
0·0	322°	0·0	433°	0·0	232°	0·0	632°	0·0	1050°
4·0	355	6·25	465	4·86	221	5·0	613	0·5	1045
10·6	422	30·0	595	16·66	312	10·0	590	20·0	1250
21·75	525	52·17	695	25·0	355	25·0	560	33·33	1310
36·23	660	58·0	715	33·33	390	33·33	540	50·0	1340
42·0	710	62·0	690	40·0	430	50·0	495	55·55	1370
51·0	755	72·50	695	50·0	475	55·0	482	66·66	1400
60·16	805	76·60	730	58·82	535	60·0	492	100·0	1450
68·65	840	89·54	870	66·66	600	66·6	525	—	—
77·63	880	94·24	910	74·62	682	75·0	583	—	—
86·1	925	100·0	954	83·33	815	83·33	750	—	—
91·8	945	—	—	90·90	900	90·9	885	—	—
95·5	950	—	—	100·00	954	100·0	954	—	—
100·0	954	—	—	—	—	—	—	—	—

In the case of the silver-cadmium, silver-zinc, and silver-tin alloys, the variations in the melting points are not analogous to those observed in the case of the salts previously referred to. Further, whilst, as a rule, the addition of a small quantity of metal to another more fusible metal lowers the melting point, the reverse is the case with silver and cadmium, and silver and zinc. The melting points of tin and bismuth are raised by the addition of small quantities of antimony, which is isomorphous with bismuth. The immediate raising of the melting point of the more fusible of the two constituents of the alloy seems to be intimately related to the phenomena of isomorphism.

The curve of the melting points of the copper-nickel alloys indicates the formation of a compound, CuNi, whilst the corresponding curve for the silver-antimony alloys indicates that they are simply mixtures. C. H. B.

Magnesium Cobaltite. By E. Dufau (*Compt. rend.*, 1896, **123**, 239—240).—When an intimate mixture of 150 grams of cobaltic oxide, Co_2O_3, and 75 grams of magnesium oxide is heated for 10 minutes in the electric furnace with an arc from 300 ampères and 70 volts, *magnesium cobaltite*, CoO_2Mg, is obtained as a very deep, garnet-red, crystalline mass of sp. gr. 5·06 at 20°. Its hardness is between 4 and 5. The cobaltite is dissolved by hydrofluoric acid, by hydrochloric acid with evolution of chlorine, and by nitric and sulphuric acids with evolution of gas, and it is also decomposed and partially dissolved by ammonia. Oxygen is without action on it at a red heat, but sulphur converts it into cobalt sulphide at a lower temperature. Chlorine attacks it with production of cobaltous chloride, which sublimes, and bromine behaves similarly, but iodine seems to have no action. Dry hydrogen fluoride and dry hydrogen chloride also decompose it readily, but fused oxidising agents have no action on it. C. H. B.

Electro-Chemical Method of preparing Metallic Hydroxides. By Richard Lorenz (*Zeits. anorg. Chem.*, 1896, **12**, 436—441).—A bath of potassium or sodium chloride, sulphate, or nitrate, dissolved in water, is used according to the ease with which the several hydroxides are formed in these solutions. The cathode consists of a platinum plate, and the anode of a plate of the metal whose hydroxide is to be prepared. The electrolyte is continually stirred, and the metallic hydroxide is obtained as an insoluble precipitate. An anode of copper in a solution of potassium chloride, gives a yellowish-red precipitate of cuprous hydroxide, and in a solution of potassium nitrate, a blue precipitate of cupric hydroxide. Silver, magnesium, zinc, cadmium, aluminium, lead, manganese, and iron, when treated by this method, are easily converted into their hydroxides. Mercury gives no precipitate when treated in a bath of potassium chloride, calomel being formed; in a bath of potassium nitrate, a black precipitate is obtained. Thallium, when treated in baths of the potassium salts, becomes covered with a coat of suboxide, and a brown precipitate of thallium hydroxide is very gradually formed. Tin, when treated in a bath of chloride, sulphate, or nitrate, yields orthostannic acid, which, by this method, is easily obtained pure. Antimony and bismuth, treated by this method, become coated with a grey skin, and no hydroxides are formed. Nickel, in a bath of the nitrate, becomes quickly coated with a black skin; in a bath of the chloride, the green hydroxide is very easily obtained.

The method is applicable to the preparation of hydroxides which are insoluble in water; hydroxyl ions and metal ions are formed in equivalent proportions, and therefore the hydroxide is obtained in neutral solutions, and this is a great advantage over the chemical method, where it is necessary to wash the hydroxides free from alkali. Since the precipitated hydroxides are formed in the solution, and not at the cathode or anode, the latter do not become foul, and a large quantity of the hydroxide can be prepared with the same strength of current and solution. It is important that the anodes should be made of pure metal, as it is the impurities in the metal alone which can contaminate the hydroxides prepared by this method. E. C. R.

Electro-Chemical Method of preparing Metallic Sulphides. By Richard Lorenz (*Zeits. anorg. Chem.*, 1896, **12**, 442—443).—The method is similar to that described in the preceding abstract for the preparation of metallic hydroxides. A cathode of copper sulphide is employed, and an anode of the metal whose sulphide is to be prepared. The bath consists of a solution of potassium or sodium chloride, nitrate, or sulphate. Copper, silver, cadmium, tin, lead, iron, and nickel sulphides are easily obtained. The method is evidently of general application, and is very convenient, as the metallic sulphides are formed in neutral solution and without using hydrogen sulphide or alkali sulphides. E. C. R.

Action of Hydrogen Sulphide on Solutions of Cupric Salts. By Bohuslav Brauner (*Chem. News*, 1896, **74**, 99; compare Coppock, this vol., ii, 562).—Investigations have been made on the complete precipitation with a slow or rapid current of hydrogen sulphide, of aqueous solutions of cupric sulphate or chloride under varying conditions of dilution, acidity, and of temperature. The resulting precipitate, greenish-black or dark olive green in colour, was washed thoroughly and successively with hydrogen sulphide solution, alcohol, carbon bisulphide, alcohol, and ether, the air being rigorously excluded throughout by means of carbonic anhydride. The washed and unwashed precipitates have been analysed; the latter always consisted of copper, combined sulphur, and free sulphur, whilst the former was neither simply Cu_4S_3 nor CuS, but apparently contained varying proportions of CuS and Cu_2S. The exact conditions under which the larger proportion of one or the other is produced are not yet known, and are to form the subject of future experiments. It is suggested that the formation of sulphoxy-compounds of copper may have something to do with the reaction. D. A. L.

Mercuric Oxy-salts. By Raoul Varet (*Compt. rend.*, 1896, **123**, 174—176).—Raoult and Guinchant have shown that mercuric oxysalts do not exist in their solutions in the form of basic salts, and the author has endeavoured to determine whether they exist as normal or acid salts. Berthelot has shown that the thermal effect of the substitution of one metal for another in a saline solution is equal to the difference between the respective heats of formation of the initial and final compounds, and, on the other hand, Andrews, and Favre and

Silberman have shown that the amount of heat developed by the substitution of one metal for another in a saline solution is independent of the nature of the acid radicle. Berthelot's determinations, however, prove that this law does not hold good for mercuric chloride, bromide, or cyanide.

On the other hand, Berthelot's determinations show that in a solution of the acetate, the displacement of potassium by mercury develops +164·9 Cals.; the determinations of Berthelot and of the author show that in solutions of the picrate a similar displacement likewise develops +164·9 Cals. In the case of the nitrate, the displacement develops +165·0 Cals., and it follows that mercuric oxy-salts obey the law of thermochemical moduli, and that the nitrate exists in solution as the normal salt.

According to Berthelot, the heat of formation of potassium hydrogen sulphate, dissolved in dilute sulphuric acid, is −2·6 Cals. less than the heat of formation of the normal sulphate. The author has found that the heat of formation of mercuric sulphate, dissolved in dilute sulphuric acid, is +170·0 Cals., and hence the displacement of potassium by mercury in such a solution will develop +165·0 Cals., exactly as in the case of other mercuric oxy-salts. It follows that mercuric sulphate, dissolved in excess of dilute sulphuric acid, is present in the form of a hydrogen salt, strictly comparable with the corresponding sodium and potassium salts. C. H. B.

Artificial Dendrites. By HENRYK ARCTOWSKI (*Zeits. anorg. Chem.*, 1896, **12**, 353—357).—Solutions of mercuric chloride, of concentration varying from 10—0·1 per cent., were left for three months in contact with marble at 39°. The oxychloride, $HgCl_2,4HgO$ (Abstr., 1895, ii, 393), separated in definite crystals from the stronger solutions; in more or less parallel, but slightly interlacing plates, from the solutions of medium strength, the plates being seen under the microscope to be built up of small cubes; and in dendritic growths, precisely resembling those of native copper, from the weaker solutions. That better crystals are got from the stronger solutions is correlated with the fact that the oxychloride in question is more soluble in these solutions; it is quite insoluble in pure water. C. F. B.

Mercurous Nitrite. By P. C. RÂY (*Zeits. anorg. Chem.*, 1896, **12**, 365—374).—This substance, $Hg_2(NO_2)_2$, is obtained by diluting yellow nitric acid, of sp. gr. 1·41, with 3 parts of water, and allowing it to remain for one or two days, best at a temperature of about 30°, in contact with a large excess of mercury; the nitrite is deposited on the surface of the metal in the form of yellow needles. It is decomposed but slowly by dilute sulphuric acid in the cold, nitrous fumes being evolved; boiling with a large excess of water decomposes it to the extent of about 78 per cent. into mercury and mercuric nitrite. The author discusses the bearing that the formation and properties of mercurous nitrite have on the constitution of nitrites and the action of metals on nitric acid; he thinks that in it the metal is directly united to nitrogen, as in the nitrites of silver, copper, and bismuth.

C. F. B.

Lanthanum Carbide. By HENRI MOISSAN (*Compt. rend.*, 1896, **123**, 148—151.)—Lanthanum oxide is easily reduced by carbon in the electric furnace, although the temperature required is somewhat higher than in the case of cerium oxide. A mixture of lanthanum oxide with four-fifths its weight of sugar carbon is placed in a carbon tube closed at one end, and heated in the electric furnace with a current of 350 ampères and 50 volts. The product is *lanthanum carbide*, C_2La, which is distinctly crystalline, and is transparent and yellow in thin slices; sp. gr. = 5·02 at 20°. It is not attacked by fluorine at the ordinary temperature, but burns brilliantly in it when gently heated; it also burns in chlorine at 250°, and in bromine and iodine vapours at 255°. When heated to redness in oxygen, it burns completely, but remains practically unaffected by sulphur vapour at the softening point of glass, or by phosphorus vapour at 700—800°. Selenium vapour, on the other hand, converts the carbide into a selenide. Nitrogen at 700—800° has little effect on it, but the residue evolves small quantities of ammonia when fused with potassium hydroxide. Carbon dissolves in the fused carbide, but separates as well crystallised graphite on cooling. Fuming nitric acid has no action on the carbide, but concentrated sulphuric acid is reduced when heated with it; dilute acids decompose it readily. When heated in nitrous or nitric oxide, the carbide burns vigorously; it is also decomposed by hydrogen chloride below a dull red heat, and fused oxidising agents attack it readily.

When mixed with water, lanthanum carbide is rapidly decomposed at the ordinary temperature, with evolution of a gas which contains about 71 per cent. of acetylene, 1 to 2 per cent. of ethylene, and 27 to 28 per cent. of methane. Small quantities of liquid and solid hydrocarbons are formed at the same time. C. H. B.

Action of Mercury Salts on Aluminium. By PERCY A. E. RICHARDS (*Chem. News*, 1896, **74**, 30—31).—Salts of mercury, or the metal itself, when brought into contact with aluminium, give rise to filamentitious excrescences of alumina, seemingly caused by the formation of an aluminium amalgam and its subsequent reaction with the moisture of the air. The excrescence reappears after washing and wiping, if the mercury has once obtained a firm hold. D. A. L.

Preparation of Potassium Permanganate by Electrochemical Means. By RICHARD LORENZ (*Zeits. anorg. Chem.*, 1896, **12**, 393—395).—A solution of potassium permanganate can be prepared by passing a current of 1·5 volt potential between an anode of commercial manganese or of ferromanganese (containing 20—25 per cent. of iron) and a cathode of porous copper oxide (such as the positive plate of a "cupron-element"), these two electrodes dipping in a solution of caustic potash contained in a beaker. Ferric oxide collects at the bottom of the beaker. C. F. B.

Action of Halogen Compounds of Phosphorus on Iron, Nickel, and Cobalt. By A. GRANGER (*Compt. rend.*, 1896, **123**, 176—178).—The author has investigated the action of the vapour of phosphorus trichloride, tribromide, and diiodide on iron, nickel, and cobalt reduced from the oxide, or better, from the oxalate. At a red heat, iron and phosphorus trichloride yield the phosphide, Fe_4P_3, in small, brilliant, iron-grey, prismatic crystals. Nickel, under the same conditions, yields the red, crystalline product described by Pelletier, but by prolonged action of the chloride, at a somewhat higher temperature, small, brilliant, yellowish-white crystals of the subphosphide, Ni_2P, are obtained. At a temperature above a red heat, but not exceeding bright redness, cobalt yields a subphosphide, Co_2P, which forms small, prismatic needles.

Phosphorus bromide does not readily attack the three metals under the conditions stated, and yields unsatisfactory results. The diiodide very readily yields the phosphides, Fe_4P_3 and Ni_2P, but does not readily attack cobalt. The trifluoride yields the same products mixed, however, with the corresponding fluorides and the products of the action of fluorine on glass.

The iron phosphide, Fe_4P_3, is attacked with difficulty by aqua regia, but the nickel and cobalt subphosphides dissolve readily in it, and also in nitric acids. All three compounds are readily attacked by chlorine and by fused alkalis, and lose phosphorus when heated.

C. H. B.

Preparation of Potassium Dichromate by Electrochemical Means. By RICHARD LORENZ (*Zeits. anorg. Chem.*, 1896, **12**, 396—397).—A solution of potassium dichromate can be prepared by passing a current of 2 volts potential between an anode of ferrochrome (containing about equal quantities of chromium and iron) and a cathode of porous copper oxide, the two electrodes dipping in a solution of caustic potash contained in a beaker. Ferric oxide collects at the bottom of the beaker. C. F. B.

Combination of Iodic acid with other Acids. By PAUL CHRÉTIEN (*Compt. rend.*, 1896, **123**, 178—180).—When 100 grams of sodium iodate and 70 grams of molybdic anhydride are boiled for some time with 3000—4000 c.c. of water, the salt,

$$I_2O_5,2MoO_3,Na_2O,H_2O,$$

is obtained in small, stellate groups of slender needles, slightly soluble in water, but soluble in nitric acid. The latter solution precipitates phosphoric acid in the form of a phosphomolybdate. Yellow molybdic acid, $MoO_3,2H_2O$, is very soluble in hot sodium iodate solution, and the liquid deposits short needles, which, when dried at 100°, have the composition $I_2O_5,4MoO_3,Na_2O$. Potassium iodate yields a salt, $I_2O_5,2MoO_3,K_2O,H_2O$, which crystallises in brilliant lamellæ, and ammonium iodate yields an analogous compound. The corresponding barium salt crystallises with 2 mols. H_2O in a bulky mass of long, slender needles, and when a nitric acid solution of this salt is mixed with an equivalent quantity of sulphuric acid, a solution of *iodomolybdic acid*, $I_2O_5,2MoO_3,2H_2O$, is obtained; this crystallises when concentrated in a vacuum, but the acid is very soluble in water.

Freshly prepared tungstic acid is insoluble in solutions of iodates or of iodic acid, but metatungstic acid combines with iodic acid in several proportions, and yields a series of iodotungstates when added to cold and somewhat dilute solutions of iodates. Potassium iodate yields crystals of the composition $2I_2O_5,4WO_3,2K_2O,8H_2O$, analogous to the iodomolybdate.

When syrupy phosphoric acid is boiled with excess of iodic acid, brilliant, nacreous, prismatic crystals are obtained, which have the composition $P_2O_5,18I_2O_5,4H_2O$, and are rapidly decomposed by moist air, and converted into a white powder. C. H. B.

Action of Ammonia on Alkali Paratungstates. By L. A. HALLOPEAU (*Compt. rend.*, 1896, **123**, 180—182).—When a large excess of ammonia is added to a concentrated solution of potassium paratungstate, a crystalline precipitate is produced; this dissolves in hot water, from which it separates in crystals of the composition $12WO_3,5K(NH_4)O + 11H_2O$. They are very thin, rhomboidal lamellæ, which act strongly on polarised light, show extinction at 27° from the axis of elongation, and generally resemble the prismatic crystals of the simple potassium or ammonium paratungstate. The double salt results from the combination in equal molecular proportions of the two simple salts, which are triclinic and isomorphous.

Under similar conditions, sodium paratungstate yields rhomboidal crystals of the compound $12WO_3,4(NH_4)_2O,Na_2O + 14H_2O$, obtained by Gibbs by the action of ammonium phosphate on sodium paratungstate in presence of alcohol. If, however, ammonia is added drop by drop to a concentrated solution of the paratungstate until the precipitate redissolves with difficulty, the solution, when concentrated, yields crystals of the compound $12WO_3,3(NH_4)_2O,2Na_2O + 15H_2O$, already described by Marignac. It loses 12 mols. H_2O at 100°. The crystals are rhombic prisms, which act strongly on polarised light, and show extinction at 36° from the axis of elongation. The acid tungstate, $16WO_3,3(NH_4)_2O,3Na_2O + 22H_2O$, is also sometimes obtained from the same liquid in prismatic crystals which show extinction at 35° from the axis of elongation.

These results afford further evidence of the differences between the chemical properties of sodium and potassium paratungstates.

C. H. B.

Specific Gravity and Specific Heat of Alloys of Iron and Antimony. By J. B. VINCENT LABORDE (*Compt. rend.*, 1896, **123**, 227—228).—The alloys were prepared by fusing antimony and iron together in a brasqued crucible.

		Mean specific heat 0—100°.	
Iron per cent.	Sp. gr. at 0°.	Found.	Calculated.
18·48	7·211	0·0639	0·0625
25·69	7·912	0·0688	0·0670
35·42	8·300	0·0753	0·0731
39·20	8·071	0·0779	0·0754
43·12	8·298	0·0797	0·0778
55·02	8·159	0·0869	0·0854
61·20	8·120	0·0903	0·0892
81·20	7·800	0·1028	0·1019

The sp. gr. is always equal to or higher than that of iron, which is the heavier constituent, and hence the formation of the alloy is accompanied by considerable contraction. At first the sp. gr. increases rapidly with the proportion of iron, and afterwards diminishes but with less rapidity. The specific heat is always higher than the value calculated for a mixture, and the more important differences are much greater than the experimental error. An alloy containing 39·2 per cent. of iron, which corresponds somewhat closely with the formula Fe_3Sb_4, shows the greatest divergence from the calculated specific heat, and its sp. gr. is also anomalous. Weiss has found that the magnetic properties of iron-antimony alloys increase suddenly when the proportion of iron reaches or exceeds that required by the formula Fe_3Sb_4.

C. H. B.

Zirconates. By FRANK P. VENABLE and THOMAS CLARKE (*J. Amer. Chem. Soc.*, 1896, **18**, 434—444).—The best method for the preparation of the zirconates is to fuse gently dried zirconia with hydroxides, or, by prolonged heating of the oxides. In the case of the alkaline earths, zirconates are produced containing one equivalent of each oxide, such as CaO,ZrO. The lithium compound obtained was LiO,ZrO. In the case of the alkalis, it seemed to be possible to obtain zirconates having a largely preponderating proportion of zirconia.

J. F. T.

Reaction between Carbon Tetrachloride and the Oxides of Niobium and Tantalum. By MARC DELAFONTAINE and CHARLES E. LINEBARGER (*J. Amer. Chem. Soc.*, 1896, **18**, 532—536).—On passing the vapour of carbon tetrachloride over heated niobic pentoxide, contained in a hard glass tube, both the pentachloride and the oxychloride of niobium are formed, but the latter in by far the greater quantity; of the gaseous products of the reaction, phosgene seems to predominate; the yield of pentachloride is not increased by carrying out the experiment in an atmosphere of carbonic anhydride, or of chlorine, this again illustrating the great tendency of niobium to enter into combination as the niobyl group.

In the preparation of a large quantity of niobyl chloride, a small quantity of an orange-coloured sublimate, more volatile than the chloride, was formed; this the authors consider to be tungsten oxytetrachloride, its formation being due to the niobic acid used being slightly contaminated with a tungsten compound.

Carbon tetrachloride has no action on tantalic acid, even at a temperature high enough to cause Bohemian glass to soften.

J. F. T.

Action of Reducing Agents on Osmium Nitroso-compounds. By L. BRIZARD (*Compt. rend.*, 1896, **123**, 182—185).—The reduction of potassium osmiamate by formaldehyde in alkaline solution yields a black, gelatinous precipitate, which dissolves in hydrochloric acid, but does not crystallise, even in presence of alkali chlorides. It contains some nitrogen, but not in the form of ammoniacal nitrogen.

If a warmed solution of the osmiamate is mixed with a hydrochloric acid solution of stannous chloride, and the liquid is concentrated, after the addition of excess of potassium chloride, *potassium amidochlorosmiate*, $NH_2{\cdot}OsCl_3,2KCl$, is obtained in small, brilliant, maroon-brown crystals, which act strongly on polarised light. The analytical results agree equally well with the formula

$$Os_2(NH_3)_2Cl_6,4KCl,$$

but this is not admissible, because the salt is completely converted into the chlorosmiate, $OsCl_4,2KCl$, by strong hydrochloric acid.

The potassium amidochlorosmiate is soluble in water, but insoluble in common organic solvents. The greenish-yellow aqueous solution gradually becomes violet at the ordinary temperature, and deposits an amorphous precipitate of the same colour, but the stability of the solution is increased by the presence of hydrochloric acid or potassium chloride. The salt is only slightly soluble in a concentrated solution of potassium chloride, and this fact can be utilised in its preparation. When heated in air, it gives off hydrogen chloride, ammonium chloride, and osmium peroxide; when heated with aqueous potash, ammonia is evolved, and a violet-black precipitate is formed, which dissolves in hydrochloric acid, but will not crystallise. When evaporated with concentrated hydrochloric acid, the amidochlorosmiate yields a red, crystalline hydrochloride, $NH_2{\cdot}OsCl_3,2KCl,HCl$, which, by further action of hydrochloric acid, is converted into the chlorosmiate, as already stated.

The amidochlorosmiate reduces permanganate, mercuric chloride, ammoniacal silver nitrate, cupric salts, and Fehling's solution.

C. H. B.

Mineralogical Chemistry.

The "Dilute Coloration" of Minerals. By ERNST WEINSCHENK (*Zeits. anorg. Chem.*, 1896, **12**, 375—392).—By dilute coloration is understood that colour of a mineral which is not natural to the pure substance, nor due to the presence of an isomorphous mineral, but is caused by the presence of a minute quantity of a coloured substance so distributed throughout the mass of the crystal that the resulting coloration exhibits the same relation to the symmetry of the crystal (pleochroism, &c.) as would a colour natural to the mineral itself. Such colorations were once attributed to the presence of "hydrocarbons," because they are destroyed, as a rule, by comparatively slight elevation of temperature. But this view is probably erroneous, for, although crystals of organic substances are readily dyed by organic colouring matters, this is rarely the case with inorganic crystals. Further, the author has demonstrated the presence of traces of titanium in smoky quartz from two different localities, whereas a specimen of colourless rock crystal was found to contain no titanium, even though in some parts of the crystal—not, of course, taken for analysis—crystals of rutile were imbedded. The smoky coloration cannot be due to titanic oxide, which is colourless, and it is suggested that it is due to the deep-coloured sesquioxide, which becomes changed to the colourless oxide on ignition, so causing a loss of the coloration. It is further suggested that the analogous oxides of tin and zirconium likewise produce dilute coloration in minerals, and possibly also the oxides of cerium and of vanadium, and of metals related to these. Ferric oxide, too, is probably responsible for many "dilute" yellow and brown shades. In all cases, the colouring agent is to be regarded as of *inorganic* nature. As to the manner in which it is present, it may be regarded as in solid solution in the crystal, or, by those who reject the hypothesis of solid solutions, as existing in the interstices between the molecules of the mineral. C. F. B.

Nitrogen and Argon in Fire-damp. By TH. SCHLŒSING, jun. (*Compt. rend.*, 1896, **123**, 233—236).—The proportion of nitrogen in fire-damp, collected in such a way as to avoid admixture with air, is very variable; in 20 specimens, the limits were 0·75 and 30·0 per cent. The proportion of argon in this nitrogen was 1·1 per cent., or almost exactly the same as in atmospheric nitrogen. Even in specimens of fire-damp issuing from the coal under high pressure, the percentage of argon in the nitrogen was 1·18. A large number of samples were analysed, and the results will be described subsequently; a considerable proportion of argon was found in every case.

Examination of the gases evolved from powdered coal in a vacuum indicates that argon, if present at all, does not occur in a higher proportion than 0·0005 per cent. by weight. C. H. B.

Examination of Gases from certain Mineral Water. By ALEXANDER KELLAS and WILLIAM RAMSAY (*Proc. Roy. Soc.*, 1895, **59**, 68—69).—A sample of inflammable gas from "Allhusen's Well" was found to contain, besides the usual constituents, nitrogen, hydrocarbons, &c., 0·4 per cent. of indifferent gas, the spectrum of which corresponded with that of argon; the helium yellow lines were not visible.

An incombustible gas from another well at the same place was also found to contain 0·5 per cent. of argon. 660 c.c. of gas from a boiling spring near Reykjavik, Iceland, was found to contain 7·45 c.c. of argon, or 1·14 per cent. No helium could, however, be detected.

J. F. T.

An Attempt to determine the Condition in which Helium and the Associated Gases exist in Minerals. By WILLIAM AUGUSTUS TILDEN (*Proc. Roy. Soc.*, 1896, **59**, 218—224).—Experiments were made in order to find out whether the gas evolved from certain minerals by the application of heat was enclosed in cavities or existed in a state of so-called occlusion. Monazite, on being enclosed in a hard glass bulb and exhausted, was found to give off below 130° only carbonic anhydride and water vapour; from 130—140°, however, gas was evolved, which for the first time showed the D_3 line of helium; between this and 446° successive quantities of gas were evolved containing helium.

Cleveite was found to behave in a similar manner.

Experiments were then made for the purpose of ascertaining whether the mineral from which the gas had been removed was capable of reabsorbing it. For this purpose, massive Swedish cleveite was employed, and it was found that the mineral did not reabsorb the helium mixture at the ordinary atmospheric pressure. In a second experiment, however, conducted under a pressure of $2\frac{1}{2}$ atmos., the mineral was found to have absorbed one-twenty-fifth of its volume of the gas. Further experiments were tried under greater pressure. The apparatus employed consisted of three glass bulbs, A, B, and C, connected by means of a horizontal glass tube, one end of which was attached to a Sprengel pump and the other to a movable reservoir of mercury capable of being raised to a great height. A contained cleveite which had been heated to 400° in a vacuum, B also contained cleveite heated to 170° in a vacuum, and C 7·5 grams of artificial lead uranate which had been heated to redness; the bulbs were heated to 100° and exhausted of air, the gas (prepared from cleveite and freed from carbonic anhydride and water) was then admitted at atmospheric pressure, and the horizontal tube at that end sealed off. The contents of the tubes were then subjected to a pressure of 7 atmos., and heated for 18 hours at 100°, the pressure being maintained for 96 hours. A was then found to have absorbed one-seventh of its volume and B more than one-fourth; the gas evolved from C consisted only of carbonic anhydride.

Cleveite, therefore, appears to reabsorb helium to an extent which is, roughly, proportional to the pressure.

As a result of further experiments, it was found that iron absorbs helium, but to a less extent than it does hydrogen, and palladium much less readily.

The gas evolved from red Peterhead granite was found to contain a large proportion of hydrogen, 15·2 grams of granite yielding 14·9 c.c. of gas, consisting of 24·8 per cent. of carbonic anhydride and 75·2 per cent. of hydrogen; no helium was evolved. Helium was not absorbed by the powdered mineral when treated in the same manner as cleveite. J. F. T.

Japanese Coal. By Frank Browne (*Chem. News*, 1896, **74**, 76—77).—The sample examined was Tubari coal from the island of Yezo. In lumps it is black, in powder chocolate-brown; it burns readily with a bright, smoky flame that soon subsides, leaving a glowing mass; it is non-caking, and contains, per cent., moisture, 3·83; volatile combustible matter, 36·62; fixed carbon, 42·70; ash, 16·85; the ultimate analysis showing C, 62·84; H, 6·37; N, 1·08; O (calculated), 11·01; S (combustible), 1·18; ash (containing 0·49 per cent. of sulphur), 17·52 per cent. Sp. gr. 1·411; heat of combustion calculated = 6,826 cals. D. A. L.

Magnetic Behaviour of Pyrrhotite. By Antal Abt (*Zeits. Kryst. Min.*, 1896, **27**, 100—101; from *Értesitö az erd. Muzeum egyl. orv.-term.-tud. szakosztályából*, 1895, **17** (20th year), 20—30, and *Ger.*, 89—100).—The author has investigated the magnetic properties of those ores in which the metals are strongly paramagnetic, namely, ores of iron, nickel, cobalt, and manganese. Two specimens of hæmatite, and all those of pyrrhotite, possessed magnetic polarity, whilst pyrites and nickel ores did not. Pyrrhotite shows a considerable amount of residual magnetism, exceeding that of magnetite, and its behaviour is similar to that of hard steel. The amount of iron in the ores examined is given by the analyses of G. Nyiredy as: magnetite, 68·20 and 67·50 per cent.; pyrrhotite, 57·58, 57·25, and 55·80 per cent. L. J. S.

Pyrrhotite from Borév. By Mór Pálfy (*Zeits. Kryst. Min.*, 1896, **27**, 101; from *Értesitö az erd. Muzeum egyl. orv.-term.-tud szakosztályából*, 1895, **17** (20th year), 54—57).—Pyrrhotite occurs with pyrites and quartz at a limestone and phyllite contact near Borév (county of Torda-Aranyoser). The massive mineral is greyish-white with a tinge of red, and is somewhat impure owing to admixed silicate. Analysis gave:

Fe.	S.	Cu.	Insol.	Total.
57·78	35·34	trace	7·20	100·32

After deducting impurities, this is near to $Fe_{11}S_{12}$. Mean sp. gr. 4·497. L. J. S.

Some New South Wales and other Minerals. By Archibald Liversidge (*Chem. News*, 1896, **74**, 113—116).—*Stibnite*, a hard, splintery variety with conchoidal fracture, from Queensland, gave, on analysis:

Sb.	S.	Fe.	SiO_2.	$BaSO_4$.	Total.	Sp. gr.
64·47	26·59	1·00	3·41	2·63	98·10	4·43

Silica and barytes occur as thin veins in the material.

Plumbiferous apatite occurs as crystals in cavities in zinciferous galena at Broken Hill. Probably part of the calcium phosphate is replaced isomorphously by lead phosphate; the crystals, however, enclose specks of galena. Pyromorphite has been found in the same mine.

Barklyite is found at Two Mile Flat, Mudgee, N.S.W., as small pebbles of a dull magenta colour. Hardness about 8·5; sp gr. 3·738. Tough, fracture granular; the powder is pale pink. It is a variety of corundum, which does not appear distinct enough to warrant a special name.

Chrysocolla is described from Broken Hill.

Beryl, from Vegetable Creek, New England, N.S.W., gave:

SiO_2.	Al_2O_3.	BeO.	Fe_2O_3.	CaO.	Total.	Sp. gr.
67·4	18·5	12·9	0·6	trace	99·4	2·80

Crocoite, brilliant, deep orange-red crystals, from Dundas, Tasmania, gave:

PbO.	CrO_3.	Fe_2O_3.	Total.	Sp. gr.
66·86	30·99	1·02	98·87	5·92

Fahlerz, massive, from Wiseman's Creek, *via* Brewongle, N.S.W.

Cu.	Pb.	Fe.	Zn.	Sb.	S.	Ni, Co.	Total.
33·004	0·630	2·844	3·693	34·620	25·207	traces	99·998

This corresponds approximately to $\frac{4}{5}CuS\frac{1}{5}(FeZn)S,Sb_2S_3$. Gold and silver are also present. [*Note.*—Tetrahedrite is $4Cu_2S,Sb_2S_3$.]

Ilmenite, from Cloncurry River, Queensland, gave:

TiO_2.	SiO_2.	FeO.	Fe_2O_3.	Total.
49·85	1·01	35·70	13·22	99·78

Manganese and magnesium are absent.

Zinciferous galena, occurring in nodules at Broken Hill, contains only a little zinc; blende is absent. The vein-stuff, however, gave:

Pb.	Zn.	S.	Fe.	Cu.	As,Sb.	Insol.	Total.
60·20	15·50	18·94	2·62	0·205	traces	3·16	100·625

This corresponds with $3PbS + 2\frac{1}{2}ZnS$, and seems to be related to huascolite and kilmacooite.

Limestone, from Picton, N.S.W., showing cone-in-cone structure, contained 68·20 per cent. $CaCO_3$.

Molybdenite, from Eleanora mine, Kingsgate, near Glen Innes, N.S.W.; sp. gr. 4·6.

Mo.	S.	Fe.	Total.
57·31	42·00	1·50	100·81
58·66	41·23	0·39	100·28

Another specimen contained about 6 per cent. of manganese oxide, but probably mechanically enclosed between the folia.

Proustite is described from the United mine, Rivertree.

Scheelite, massive, from Lady Hopetoun mine, Glen Innes, N.S.W. Sp. gr. 5·93; of another portion, 5·3. It contains, besides $CaWO_4$, a little water, 2·23 per cent. SiO_2, 1·52 per cent. Fe_2O_3, and a trace of manganese.

Cassiterite, from Elsmore mine, Inverell, N.S.W. I, stout pyramids; hardness 6·5; powder, white. II, water-worn fragments; hardness 7; powder, brown.

	SnO_2.	SiO_2.	Fe_2O_3.	MnO.	WO_3.	Total.	Sp. gr.
I.	94·60	2·00	1·67	0·25	0·06	98·58	6·68
II.	92·52	1·68	3·21	0·98	0·36	98·75	6·54

The loss in these analyses may indicate the presence of rare elements.

Topaz, in short prisms on granite, from the Shoalhaven district, gave the following mean of two analyses:

SiO_2.	Al_2O_3.	F.	H_2O (at 100°).	Total.	Sp. gr.
28·19	62·66	14·01	1·21	106·07	3·56

L. J. S.

Pearceite, and the Crystallisation of Polybasite. By SAMUEL L. PENFIELD (*Amer. J. Sci.*, 1896, [4], **2**, 17—29; and *Zeits. Kryst. Min.*, 1896, **27**, 65—77).—As corresponding sulpharsenites and sulphantimonites usually receive different designations, the name pearceite, after Richard Pearce, is proposed for the arsenical varieties of polybasite, $9Ag_2S,Sb_2S_3$, pearceite being $9Ag_2S,As_2S_3$. Minerals to which this name can be applied are the arsenical polybasite from Schemnitz analysed by H. Rose, in 1833; that of Aspen, Colorado, described by Penfield; by S. H. Pearce (Abstr., 1893, ii, 75); and the mineral described in the present paper. Two other old analyses show arsenic and antimony in about equal molecular proportions.

The mineral here described occurs beautifully crystallised at the Drumlummon mine, Marysville, Lewis and Clarke Co., Montana. Analysis by F. C. Knight gave the following results:

S.	As.	Ag.	Cu.	Fe.	Insol.	Total.
17·71	7·39	55·17	18·11	1·05	0·42	99·85

This gives $S : As : (Ag_2 + Cu_2 + Fe)$ as very nearly 12 : 2 : 9, as is required by the above formula, with $Ag_2 : Cu_2 : Fe = 255 : 143 : 19$. The monosymmetric crystals are usually flat, hexagonal tablets, often with highly modified edges. $a : b : c = 1·7309 : 1 : 1·6199$; $\beta = 89° 51'$; $mm = 60° 2'$. On the basal plane are triangular markings, and the crystals show indications of twinning. The colour and streak are black; lustre, metallic; opaque, even in thin splinters. Sp. gr. 6·15. Brittle with no distinct cleavage.

Polybasite, which has been described as being rhombohedral, and more recently as orthorhombic, is here shown to be monosymmetric. A crystal from Himmelfahrt mine, Freiberg, is described, which consists of a rhombohedron with basal plane; this would be difficult to explain if the mineral were orthorhombic. Measurements of perfect crystals from Yankee Boy mine, Ouray, Colorado, gave $a : b : c = 1·7309 : 1 : 1·5796$; $\beta = 90° 0'$; $mm = 60° 2'$.

These parameters of pearceite and polybasite show that there is a tendency for arsenic to increase the length of the vertical axis, and this is also to be noticed in several other cases, for example, in proustite and pyrargyrite. A close similarity is pointed out between these parameters and those of copper glance (Cu_2S), stromeyerite ($CuAgS$), and many sulpharsenites and sulphantimonites, all of which have a prism angle of nearly 60°; this would seem to indicate that the sulphide of the metal has had a controlling influence on the crystallisation. L. J. S.

Rathite, a new Binnenthal Mineral. By HEINRICH BAUMHAUER (*Zeits. Kryst. Min.*, 1896, **26**, 593—602).—Rathite is very similar in appearance to the Binnenthal minerals, jordanite, dufrenoysite, and sartorite, which are also compounds of lead, arsenic and sulphur; it is distinguished from these by the presence of parallel systems of very fine striæ, by the twinning, and by the crystal angles. The fine striæ are seen with the aid of a lens, in light at a particular angle, on the crystal faces and on fractured surfaces; it is evidently due to a lamellar structure (which may be isomorphous banding or twinning) of the crystals parallel to the faces of a brachydome. The crystals are orthorhombic, and, like those of the minerals mentioned above, are elongated and striated in the direction of the macroaxis, and are rich in macrodomes. In the twin crystals, the striated zones of two individuals intersect at an acute angle.

$$a : b : c = 0·668099 : 1 : 1·057891.$$

Multiplying a and c by $\frac{3}{2}$, there is a close relationship between these parameters and those of dufrenoysite. Sp. gr. 5·32. Analysis by A. Bömer gave:

Pb.	S.	As.	Sb.	Fe.	Total.
52·98	23·72	17·24	4·53	0·56	99·03

The antimony is probably too low. A mixture of 5 mols. of dufrenoysite ($2PbS,As_2S_3$), and 1 of jamesonite ($2PbS,Sb_2S_3$), does not correspond so closely to this composition as does a mixture of 5 mols. of $2PbS,As_2S_3 + 2PbS,As_2S_5 = 4(PbAsS_3)$, and 1 of $2PbS,Sb_2S_3 + 2PbS,Sb_2S_5 = 4(PbSbS_3)$; the second formula is adopted, and is also expressed structurally. It is supposed that the fine striæ are due to the alternate banding of these two isomorphous compounds, and that the partial replacement of As_2S_3 and Sb_2S_3 by As_2S_5 and Sb_2S_5 accounts for the morphotropic relationship between rathite and dufrenoysite. The mineral is named after the late G. vom Rath.

L. J. S.

[**Calcistrontite, "Feather Ore," &c.**] By E. A. HUGO LASPEYRES and E. KAISER (*Zeits. Kryst. Min.*, 1896, **27**, 41—59).—Calcistrontite was the name used by von der Marck (*Verh. Ver. Rheinlande und Westfalens*, 1882, **39**, 84, Corr.-bl.) for a mineral from Drensteinfurt, near Hamm, Westphalia, which he considered to be an isomorphous mixture having the composition $3CaCO_3,2SrCO_3$. It is here shown to be a mixture of calcite and strontianite; grains of granular strontianite being enclosed in crystalline calcite, the calcite itself forming a granular aggregate. This is well seen in microscopic sections, and, by means of heavy solutions, the two minerals can be separated.

By means of microchemical tests, and the indications of cleavage, it is shown that what has been labelled as "feather ore," from various localities, is really capillary stibnite, and not jamesonite.

A simple apparatus for use in separating minerals by means of heavy solutions is described.

Crystallographic and other notes are given concerning copper glance, blende, quartz, &c.

L. J. S.

Pollucite, Manganocolumbite and Microlite from Rumford, Maine. By H. W. FOOTE (*Amer. J. Sci.*, 1896, [4], **1**, 457—461; and *Zeits. Kryst. Min.*, 1896, **27**, 60—64).—These minerals occur at Black Mountain, Rumford, Maine, in a coarse pegmatite, together with quartz, albite, muscovite, tourmaline, lepidolite, spodumene, amblygonite, beryl, cassiterite, and columbite. The pollucite occurs in irregular masses, and closely resembles white quartz in appearance, but some small particles are colourless and transparent. The material separated for analysis had sp. gr. 3·029—2·938; the cæsium was separated and estimated as Cs_2PbCl_6; only a trace of rubidium was detected by the spectroscope. The mean of two analyses is:

SiO_2.	Al_2O_3.	Cs_2O.	K_2O.	Na_2O.	Li_2O.	H_2O.	Total.
43·64	16·84	36·14	0·37	2·09	0·08	1·58	100·74

This gives the same formula as that recently deduced by Wells for the mineral from Hebron, namely, $H_2Cs_4Al_4(SiO_3)_9$.

The dark, reddish-brown mangano-columbite is described crystallographically; $a : b : c = 0·8359 : 1 : 0·8817$. Sp. gr. 6·44. The honey-yellow, octahedral crystals of microlite have sp. gr. 5·17.

L. J. S.

Mineralogical Notes [Scapolite, &c.]. By ALFRED J. MOSES (*Zeits. Kryst. Min.*, 1896, **26**, 603; from *School of Mines Quart.*, 1894, **14**, 323).—The ettringite described by the author from Tombstone, Arizona (Abstr., 1893, ii, 536) incrusts, and has evidently been derived from, a silicate which the following analyses show to be an altered scapolite. It is white (Anal. I) or pale green (II), incoherent and corroded, and mixed with ores.

	SiO_2.	Al_2O_3.	CaO.	MgO.	Na_2O.	H_2O (at 110°).	H_2O (ignition).
I.	45·86	21·56	12·79	2·43	1·16	4·45	11·74
II.	45·50	21·14	11·96	1·34	—	7·07	12·98

Impurities have been deducted and the analyses calculated to 100. Formula, $(SiO_4)_{15}Al_8(Ca,Mg,Na_2)_6H_{24} + 6H_2O$. Sp. gr. 2·66. The gigantic crystals of gypsum from near South Wash, Wayne Co., Utah, are described; also heulandite and stilbite from New Jersey.

L. J. S.

Physiological Chemistry.

Gaseous Exchanges in Inhabitants of the Tropics. By C. EIJKMAN (*Pflüger's Archiv*, 1896, **64**, 57—78).—The oxygen used up was found to be, for Europeans in Europe 250·3, in India 245·7, and for Malayans, 251·5 c.c. per minute. The respiratory quotient for the same three classes is 0·775, 0·768, and 0·856 respectively. The differences are thus but small, and give little information as to the influence of climate on heat-regulation. The high respiratory quotient in the case of the Malayans follows from their richly carbohydrate diet. W. D. H.

Percentage of Argon in Atmospheric and Respired Air. By ALEXANDER KELLAS (*Proc. Roy. Soc.*, 1895, **59**, 66—69).—Experiments were made on the comparative amount of argon in ordinary air, and in air which had been frequently breathed, with the view of ascertaining whether, if the proportion of oxygen and carbonic anhydride in air be very much altered, argon would enter into, or be expelled from the respiratory system.

The amount of argon in 100 c.c. of atmospheric nitrogen was found to be 1·186 c.c., which owing to the avoidance of the presence of water, is probably more accurate than the numbers 1·04, 1·03, and 1·11 c.c., originally found by Lord Rayleigh and Ramsay.

One hundred c.c. of nitrogen and argon of breathed air (of normal composition) were found to contain 1·210 c.c. of argon.

The percentage is larger than in normal air, but the difference is not great; it would appear, therefore, that argon, like free nitrogen, plays no important part in the animal economy, save as a diluent.

J. F. T.

Action of Pancreatic Juice on Milk. By William D. Halliburton and T. Gregor Brodie (*J. Physiol.*, 1896, **20**, 97—106).—Doubt having arisen as to whether the results obtained with extracts of the pancreas are applicable to those obtained with the secretion of that organ, the present experiments were performed with the pancreatic juice obtained from dogs by means of a temporary fistula.

The action which the juice has on milk is different from that of rennet, a precipitate of caseïn occurring in the warm bath (at 35°—40°) in a finely granular form, the milk to the naked eye undergoing no change in its fluidity. On cooling this to the temperature of the air, it sets to a coherent curd which contracts to only a small extent, and is again broken up into fine granules by warming to 35°, the milk apparently becoming fluid again. This may be repeated a great number of times. This phenomenon is not prevented, but only slightly hindered by such an addition of potassium oxalate as completely inhibits the activity of rennet. Experiments performed with extracts of the gland lead to similar results, which may be masked if the action of the tryptic ferment is very energetic. The precipitate produced may be provisionally termed "pancreatic caseïn." By the action of rennet, it is converted into true caseïn. Its solubilities are partly like those of caseïnogen, partly like those of caseïn. It is probably something intermediate between the two.

W. D. H.

Metabolism in Poisoning by Carbonic Oxide and Nitrobenzene. By Egmund Münzer and P. Palma (*Chem. Centr.*, 1896, i, 55—56; from *Zeits. f. Heilk.*, **15**).—In carbonic oxide poisoning there is an increased katabolism in the body. A larger amount of nitrogen than usual leaves the body as ammonia and uric acid, and the excretion of acetone is also increased; this diminishes the next day. The excretion of phosphoric acid is normal for the first two days, and sinks below the normal during the third and fourth day. Glycosuria may occur, and lactic acid be present in the urine, as Araki pointed out.

In a case of poisoning by nitrobenzene, the nitrogen excreted was small, the amount of phosphoric acid was about the normal, and ethereal hydrogen sulphates were increased. On the fourth day glycosuria made its appearance. Poisoning by these substances is compared to that by phosphorus.

W. D. H.

Use of Sugar in Cattle Feeding. By Malpeaux (*Ann. Agron.*, 1896, **22**, 281—296).—Two heifers and two bullocks of known weight were fed with clover hay (2 kilos.), oat straw (5 kilos.), maize and cotton cake, in addition to pasture. For 25 days one of each received besides, 500 grams of sugar daily. The results of the experiments were not very decisive, but sugar seemed to assist production of meat, being both a maintenance and a fattening food.

In experiments with cows, sugar did not increase milk production, or appreciably affect the composition of the milk. N. H. J. M.

Nutritive Value of Caseïn. By GOTTHELF MARCUSE (*Pflüger's Archiv*, 1896, **64**, 223—248).—The experiments were conducted in the usual manner of experiments on metabolism and full details are given. The main conclusion is that the nutritive value of caseïn is the same as that of the proteïds of flesh. W. D. H.

Intestinal Absorption. By E. WAYMOUTH REID (*J. Physiol.*, 1896, **20**, 298—309).—The general conclusion drawn from the experiments described, is that the effects of excitation and section of the mesenteric nerves on the absorption of peptone and water, can be explained by the concomitant changes in the blood supply to the loops of gut induced by the action of the vaso-motor nerves on the arterioles, and there is no proof of the existence of specific absorptive nerve fibres. W. D. H.

The Basophil Constituent of Sympathetic Nerve-cells. By F. C. EVE (*J. Physiol.*, 1896, **20**, 334—353).—The granules in nerve-cells that have an affinity for basic dyes like methylene-blue have been long known, and some observers have described in them changes as the result of activity. In the present research, this basophil constituent was investigated in sympathetic nerve-cells, and the only change to be detected in them as the result of protracted activity is a slight diffuse blue stain in the cell substance, which is attributed to the formation of acid by the cell, and a consequent slight solution and diffusion of the basophil material.

W. D. H.

Physiology of the Embryonic Heart. By JOHN W. PICKERING (*J. Physiol.*, 1896, **20**, 165—222; compare Abstr., 1893, ii, 424).—The hearts of mammalian embryos, even after being excised from the mother, maintain a fairly constant individual rhythm for three or four days, if they are bathed in a suitable nutrient material. The best nutrient was found to be a mixture of equal parts of the mother's blood, and 0·75 per cent. solution of sodium chloride. If the mother's blood is replaced by that of another species, or by egg-albumin, the beating of the heart becomes irregular, although it may last for several days. The sodium chloride solution alone will maintain activity for one day; the sustaining power of Ringer's solution, the ash of blood, and of gum arabic is about the same as that of sodium chloride. Grimaux's "colloïde aspartique" is nearly as good as blood; the "colloïde amidobenzoique" kills in from 18 to 24 hours. Water, distilled in glass receivers, is innocuous, although not sustaining; water distilled in metal receivers is toxic (oligo-dynamic action). The general results with drugs are similar to those previously obtained with chick embryos, except that muscarine nitrate and atropine sulphate exhibit their typical and antagonistic action on both early and late embryos. This, however, is not the case, in the chick's heart prior to the development of a nervous mechanism; chloroform is a depressant, but a small quantity of alcohol mitigates this action. Ether, except in large doses, applied direct to the heart is a stimulant. A large section of the paper is devoted to the action of electrical currents on the heart. W. D. H.

Estimation of Ethylic Alcohol in the Blood after introduction of the Liquid into the Veins, or the Vapour into the Lungs. By NESTOR GRÉHANT (*Compt. rend.*, 1896, **123**, 192—194).—Alcohol of 25 per cent. was injected into the jugular vein of a dog until the quantity of alcohol was about 1/25th of the weight of the blood, which approximates to a toxic dose. The quantity of alcohol present was determined at intervals by means of a modification of the dichromate process. In one case in which the quantity of alcohol injected was 4·9 c.c. in 100 c.c. of blood, there was only 0·72 c.c. after half an hour, 0·54 c.c. after $1\frac{1}{2}$ hours, 0·45 c.c. after $2\frac{1}{2}$ hours, and 0·15 c.c. after $17\frac{1}{2}$ hours. The alcohol passes into the lymph, or is absorbed by the tissues. In another case only 0·2 c.c. of alcohol remained in 100 c.c. of blood after 15 hours, and it had all disappeared after $23\frac{1}{3}$ hours.

When a dog was made to inspire air saturated with alcohol vapour at 22°, 100 c.c. of blood contained 0·1 c.c. of alcohol after two hours' respiration, 0·31 c.c. after four hours, and 0·50 c.c. after six hours. At this point the experiment was stopped; the animal was very ill, but it recovered during the night. C. H. B.

Blood Coagulation in Albinos. By JOHN W. PICKERING (*J. Physiol.*, 1896, **20**, 310—315).—The condition of the blood varies in animals that are sometimes in an albino and, at other times, pigmented condition. During the albino condition of the Arctic hare, intravenous injection of a nucleo-proteïd or of Grimaux's synthesised proteïd-like colloïds fails to produce intravascular coagulation, whilst during the pigmented condition, coagulation is produced. When the animal is in a transition stage, the effects are inconstant. The "colloïdes amidobenzoiques" of Grimaux are without effect on extravascular blood (dogs and rabbits), but the addition of "colloïde aspartique" to the blood immediately it is shed, hastens its coagulation. W. D. H.

Initial Rate of Osmosis of Blood Serum. By W. S. LAZARUS-BARLOW (*J. Physiol.*, 1896, **20**, 145—157; compare this vol., ii, 196).—At a temperature of 37°, the blood serum of the ox, horse, and sheep is in osmotic equilibrium with a 1·6 per cent. solution of sodium chloride placed on the other side of the membrane. This is approximately the same as saying that the initial rate of osmosis of the serum is equal to that of a 1·6 per cent. solution of sodium chloride. The greater the amount of proteïd which a specimen of serum contains, the more concentrated must be the solution of sodium chloride on the other side of the membrane to produce osmotic equilibrium. Owing to dialysis, a solution of sodium chloride which at first increases in quantity at the expense of the serum, may, later, become absorbed by the serum. W. D. H.

Sugar-formation in Alcohol Coagulated Liver. By FREDERICK W. PAVY (*Proc. Physiol. Soc.*, 1896, 4—6).—That sugar rapidly appears in the liver after death is an established fact. It is maintained that this is strictly a *post-mortem* phenomenon, and not a true picture of what occurs during life. It is a ferment action, not a vital action, and occurs equally well in a liver which has been coagulated by alcohol immediately after its removal from the body, and then kept in alcohol for months; on being dried and exposed to a suitable temperature in water, sugar is formed in amount approximately equal to that obtained from the fresh liver. W. D. H.

Behaviour of Polysaccharides with certain Animal Secretions and Organs. By EMIL FISCHER and W. NIEBEL (*Chem. Centr.*, 1896, i, 499—501; from *Sitzungsber. kgl. pr. Akad. Wiss.*, 1896).—Fluids like blood serum, or clear solutions or infusions of various organs were used, toluene or sodium fluoride being added to prevent the activity of living cells; the carbohydrate was added, and the mixture kept in a warm bath for 24 hours. Acetic acid was then added, the mixture boiled, the proteïd filtered off, and the filtrate examined for carbohydrates. The results obtained were the following:—Starch, glycogen, and maltose are changed into dextrose by the secretions of different animals. Lactose is not affected by blood-serum; extracts of portions of the small intestine, especially in young animals, however, affect its hydrolysis; it is not affected by any other secretion. Cane-sugar is not affected by blood, or by infusion of stomach; extracts of duodenum of ox and sheep differ from those of other animals by also giving a negative result. Trehalose is feebly hydrolysed by the same extract from some animals, and not at all by that from others. Blood-serum is also ineffective, except that obtained from certain fishes—especially the carp. Raffinose is not altered by the invertin of the intestine, which must, therefore, be a different substance from the invertin of yeast.

Certain glucosides were also investigated. α-Methylglucoside, although so readily decomposed by beer yeast, is unaffected, or only slightly affected, by animal secretions and extracts; β-methylglucoside was decomposed by the secretion of the horse's small intestine. Amygdalin was readily decomposed by the contents of the rabbit's small intestine, but hardly at all by that of the dog. Throughout the experiments great differences are observable—according to the animals used. W. D. H.

Separation of Colloïds and Crystalloïds. By CHARLES J. MARTIN (*J. Physiol.*, 1896, **20**, 364—371).—The filtering apparatus described briefly consists of a Pasteur filter, in the pores of which a membrane of gelatin or silicic acid has been deposited; the filtration being effected under pressure; colloïd substances do not, crystalloïd substances do, pass through the filter. The native proteïds (albumins, globulins, caseïnogen, and nucleo-proteïds), glycogen, soluble starch, hæmoglobin, hæmatin, and the lipochrome of serum and egg-white do not pass the filter. Alkali albumin and acid albumin pass through to a slight degree. Caramel, biliverdin, and dextrins pass through partially. Proteoses, urochrome, and crystalloïds pass through. The crystalloïds pass through at the same rate as water. The colloïd substances which are in true solution do not pass the membrane on account of the large size of their molecules. That albumin is in true solution is evident from the fact that it exerts osmotic pressure.

The membranes are recommended for use in the study of diffusion, undisturbed by mixing caused by convection currents, but more particularly for the effective separation of crystalloïds from colloïds, which is much required in the manipulations of chemical physiology.

W. D. H.

Influence of Food containing Nucleïn on the Formation of Uric acid. By F. Umber (*Chem. Centr.*, 1896, 617; from *Zeit. Klin. Med.*, **29**, 174—189).—The administration of a large amount (500 grams *per diem*) of food like thymus, which contains a considerable quantity of nucleïn, increases the excretion of uric acid, as compared with that passed when a similar amount of flesh is given. The same amount of liver in one person caused an effect similar to that caused by thymus, but in others its action was less marked. Kidney and brain gave nearly the same amount of uric acid as flesh, and milk less still. The xanthine bases are increased by administration of alkalis, and of milk.

W. D. H.

Influence of Atropine on the Secretion of Urine. By Ludwig Walti (*Chem. Centr.*, 1896, i, 263; from *Arch. exp. Path. Pharm.*, **36**, 411—436).—Atropine lessens the secretion of urine, and hinders the action of diuretics. The injection of large or small quantities of urea into the circulation leads to glycosuria. Simultaneous injection of atropine prevents this.

W. D. H.

Creatinine. By Percy Cooper Colls (*J. Physiol.*, 1896, **20**, 107—111).—Urinary creatinine, like sugar, is precipitated from aqueous solutions and from urine, when Brücke's lead-acetate method is employed. It is probable that Pavy's high figure for the percentage of sugar in normal urine is due to this circumstance.

Blood contains a small but ponderable amount of creatinine; in sheep's blood the percentage found being 0·000095. Creatinine was separated from the blood as the spherical mercury salt by a slight modification of G. S. Johnson's process.

W. D. H.

A New Solvent for Urinary Pigments. By William Kramm (*Chem. Centr.*, 1896, i, 713—715; from *Deutsch. Med. Woch.*, **22**, 25—27, 42—45).—Liquid phenol is a direct solvent of the urinary pigments. Twenty parts of urine are shaken with one of phenol, the urine having first been saturated with a neutral salt, such as sodium chloride or sulphate, or ammonium sulphate; the pigments then pass into the phenol. Tricresol behaves in the same way, but more slowly. The phenol extract is mixed with ether and shaken with water; the water becomes yellow, the phenol and ether reddish. The yellow pigment is urochrome, the reddish one urobilin. The red pigment of urate deposits is not soluble in phenol. W. D. H.

Phloridzin Diabetes. By Nathan Zuntz (*Chem. Centr.*, 1896, i, 613; from *Du Bois Reymond's Archiv.*, 1895, 570—574).—An important difference between ordinary diabetes and that produced by phloridzin, is that in the former case the blood is rich in sugar, in the latter it is not. The kidneys must, therefore, in this case act most energetically in withdrawing the sugar from the blood. This increase in the power of the kidney cells was proved by an experiment on a dog in which the urine was collected separately from the two kidneys, into the renal artery of one of which a small amount of phloridzin solution was injected; this one secreted urine containing sugar, the other secreted normal urine. W. D H.

Alloxuric Substances in the Urine in Nephritis. By G Zülzer (*Chem. Centr.*, 1896, i, 616—617; from *Berlin Klin. Woch.*, **33**, 72—75).—In health, according to Kolisch, nucleïn derivatives are mainly transformed in the kidneys into the non-toxic uric acid, while a small part passes out as the poisonous alloxuric bases. The normal amount of these bases *per diem* is given as 0·04—0·06 gram, and the relation between their nitrogen and that of uric acid as 1 : 3·82; or the nitrogen of alloxuric bases, to that of total alloxuric substances as 1 : 4·82. His expectation that this relationship would be upset in nephritis is, in the present research, not confirmed.

W. D. H.

Febrile Albumosuria. By Ludolf Krehl and Max Matthes (*Chem. Centr.*, 1896, i, 54—55; from *Deutsch. Arch. Klin. Med.*, **54**, 501—514: and *Chem. Centr.*, 1896, i, 263; from *Arch. exp. Path. u. Pharm.*, **36**, 437—450).—Many proteïd substances raise the body temperature, and appear partly in a hydrated form in the urine. The elevated temperature in many acute specific fevers can be partly accounted for in this way, and proteoses are found in the urine. Deuteroproteose is the form most frequently found, and is believed to originate from the bacterial decomposition of nucleo-proteïds.

Tuberculous animals respond especially well, by a febrile reaction, to small injections of proteose. Toxic proteïds, like ricin, abrin, and tuberculin produce similar results. W. D. H.

Effect of Drugs on the Tracheal Secretion. By James Calvert (*J. Physiol.*, 1896, **20**, 158—164).—A window in the trachea of an animal (cat under chloroform, urethane, or morphine) being made, and the surface dried by blotting paper, drugs were injected into a vein or subcutaneously, and the rate of formation of secretion observed, and compared with that before the administration of the drug. It was found that alkalis increase the secretion in spite of Rossbach's assertion (*Berlin klin. Woch.*, 1882) to the contrary; that potassium iodide acts similarly, and emetine only markedly so. Saponin (senegin) in small doses does not increase secretion; in large doses it diminishes it. Cold and heat applied to the abdomen increase and diminish secretion respectively. W. D. H.

Toxicological Notes on Ortho- and Para-Compounds. THOMAS BOKORNY (*Pflüger's Archiv*, 1896, **64**, 306—312).—Experiments are described which show that in the same organism para-compounds are more poisonous than the corresponding ortho-compounds. W. D. H.

Chemistry of Vegetable Physiology and Agriculture.

Influence of Oxygen on Yeast Fermentation. By R. RAPP (*Ber.*, 1896, **29**, 1983—1985).—The author has repeated the experiments of Chudiakow (Abstr., 1895, ii, 282) on the influence of oxygen and hydrogen on the fermentation produced by yeast, and finds that, contrary to Chudiakow's statement, oxygen does not exercise any retarding effect. The passage of a rapid stream of either gas does produce a diminution of the fermentation, and the author suggests that in the former experiments the oxygen may have been passed more rapidly through the mixture than the hydrogen, and thus have produced a relative diminution of the action of the yeast. A. H.

Fermentation of Uric acid by Micro-organisms. By ERNEST GÉRARD (*Compt. rend.*, 1896, **123**, 185—187).—The author has previously shown (*Compt. rend.*, **122**, 1019) that uric acid dissolved in sodium phosphate solution is converted into urea and ammonium carbonate by the action of micro-organisms derived from the air, and has suggested that the ammonium carbonate results from the action of some urophagic microbe on the urea, the latter being the true product of the fermentation of the uric acid.

Cultivations in peptonised broth have not led to the isolation of the bacilli or cocci which act on the uric acid, but they have enabled the author to separate these organisms from those which convert urea into ammonium carbonate. When mixed with selected cultivations, the uric acid, dissolved in sodium phosphate solution, is completely converted into urea, but the latter remains unchanged even after several months. Magnier de la Source has shown that when uric acid is boiled with water, it is converted into dialuric acid, and that the latter, when hydrolysed, yields urea and tartronic acid. The author considers that the chemical action of the micro-organisms on uric acid is represented by the equation $C_5H_4N_4O_3 + 4H_2O = 2CON_2H_4 + C_3H_4O_5$. C. H. B.

Nitrification. By EMIL GODLEWSKI (*Ann. Agron.*, 1896, **22**, 303—304; from *Anzeiger Akad. Wiss.*, *Krakau*, 1895, 178—192).—The results of previous experiments (Abstr., 1893, ii, 544) indicated that nitrifying organisms probably derive their carbon from carbonic anhydride, and not from carbonates. Three experiments are now described, in which the same amounts of solutions of ammonium sulphate (with magnesium carbonate) were inoculated at the same time with pure cultivations of nitrifying organisms. In two experiments the apparatus was filled with air containing carbonic anhydride, in the third with pure air. At the end of the experiments, the air was measured and analysed. With carbonic anhydride, there was a reduction of volume, whilst with air alone there was no reduction. Magnesium carbonate was not available as a source of carbon, but, in presence of carbonic anhydride, nearly the whole of the ammonia was converted into nitrous acid. A portion of the nitrogen of the ammonia is liberated. The amount of free nitrogen produced varies according to the conditions of the experiment. N. H. J. M.

Nitrification. By Marcille (*Ann. Agron.*, 1896, **22**, 337—344).—Experiments were made on the relative suitability of ammonium sulphate and phosphate for nitrification. Whilst the phosphate was not found to be more suitable for the production of nitrous acid, it seemed more favourable than the sulphate in transforming nitrous into nitric acid.

As regards the rate of nitrification in different soils, it was found that in a given time a soil from Guadeloupe produced far more nitrates than a soil from Eure-et-Loir. This could not be due to the greater energy of the nitrifying organisms in the Guadeloupe soil, since the addition of a few grams of this soil to the French soil had no effect. It is concluded that the energy with which a soil is nitrified depends not only on the temperature, aëration, and humidity of the soil, and on the energy of the organisms present, but also on the nature of the organic matter to be nitrified. N. H. J. M.

Comparative Studies on the Poisonous Action of various Chemical Substances on Algæ and Infusoria. By Thomas Bokorny (*Pflüger's Archiv*, 1896, **64**, 262—306).—A very exhaustive paper; the experiments were performed on types of lower animal and vegetable life, and the strength of the poison noted which produced pathological changes or death. In this way, inorganic acids and bases, numerous salts, various oxidising agents (among which free halogens and potassium permanganate were the most toxic), phosphorus, organic acids, hydrocarbons, alcohols, halogen compounds, aldehydes, nitro-derivatives, sulpho-derivatives, cyanogen compounds, amido-compounds, alkaloïds, and poisonous proteïds (abrin and ricin, which are only slightly poisonous to lower organisms) were investigated. W. D. H.

Digestion of Cellulose by Enzymes. By J. Grüss (*Chem. Centr.*, 1896, i, 313; from *J. Landw.*, **43**, 379—458).—Previous observers have described the solution of vegetable cell-walls by ferments during germination; this action is ascribed in malt extract to a special ferment (cytase). It is found that the hemicelluloses undergo hydrolytic decomposition easily, although various members of the group show differences in this respect. W. D. H.

Decomposition of Vegetable Matters. By EMILE BRÉAL (*Ann. Agron.*, 1896, **22**, 362—375).—When water is kept in contact with dead vegetable matter, organisms develop which attack the organic matter, producing ammonia until the liquid becomes too alkaline. When, however, soil, containing nitrifying organisms, is added, the production of ammonia continues, as that already formed is converted into nitrates. If a vegetable infusion is poured on to a lump of soil, the ammonia produced disappears at the surface of the soil, where it is converted into nitrates, but inside the lump of soil there is an accumulation of ammonia, owing to want of aëration; even the nitrates originally present in the interior of the soil are reduced.

Humus becomes soluble in vegetable infusions owing to the ammonia which is liberated, but ceases to be dissolved when soil, containing nitrifying organisms, is added.

Vegetable infusions which have become too alkaline (ammoniacal) to support the life of ammonia-producing organisms, develop moulds which re-absorb the ammonia, producing new nitrogenous substances. This is what takes place on meadows and on peat where nitrifying organisms are absent. N. H. J. M.

Assimilation of the Nutritive Matter of the Soil by Rye. Manurial Requirements of Rye. By REMY (*Ann. Agron.*, 1896, **22**, 344—346; from *J. Landw.*, 1896, **44**, 31—103).—Experiments were made on the effect of various manures (nitrogenous, potash, and phosphatic) on the morphological development of rye. In 1891, nitrogen was taken up in proportion to the production of dry matter during the spring; whilst, in 1893, the nitrogen assimilated was in excess during this period, and the assimilation of nitrogen ceased in this year at the time when, in 1891, it had reached its greatest intensity. This is attributed to the dry season in 1893. Analogous results were obtained in 1881 by Dehérain and Meyer (Abstr., 1883, 493).

As regards the relation between assimilation of potash and phosphates, and production of dry matter, the climatic conditions do not seem to have the same influence as in the case of nitrogen. Climate has more effect on assimilation than manures.

In the case of rye, as with other cereals, nitrogen has more influence than other manures, and a large supply of nitrogen in the soil is necessary during the period of greatest assimilation. This period varies greatly according to the season.

Nitrates should not be applied (for rye) in large quantities in the autumn, when the soil is light; ammoniacal or organic nitrogen is preferable. It is better to apply nitrogen in the spring and in the form of nitrate; and the application should be delayed if the spring is cold and wet. N. H. J. M.

Analytical Chemistry.

Auto-pneumatic Stirrer. By H. BREARLEY (*Chem. News*, 1896, **74**, 63).—In place of the mechanical stirrer employed to expedite the action of the solution on the metal when treating steels, &c., with copper ammonium chloride, it is suggested to cause air to bubble through the solution by means of an aspirator. The air should be washed by passing through a solution of lead acetate. D. A. L.

A Modified Form of Measuring Flask. By HEINRICH BILTZ (*Ber.*, 1896, **29**, 2082—2083).—The flask has a bulb blown on the neck between the mark and the stopper; the air in this bulb facilitates the thorough mixing of the liquid. In filling the flask it is advisable to use a funnel in order to avoid wetting the sides of the bulb. J. J. S.

Estimation of Hydrochloric acid in Gastric Juice. By WACLAW VON MORACZEWSKI (*Chem. Centr.*, 1896, 667; from *Deutsch. med. Woch.*, **22**, 24—25).—The juice is evaporated down to 1 c.c., placed in a 100 c.c. flask, and a mixture of 25 c.c. of absolute alcohol and 75 c.c. of dry ether added to the mark. The whole is well mixed and allowed to remain; 50 c.c. of the mixture is then filtered into a larger flask, 50 c.c. of water, and a few c.c. of decinormal soda being added in order to neutralise it. It is then titrated with 1/50 normal silver nitrate solution, potassium chromate being used as indicator. After each addition of the silver solution, the flask is well shaken. Calcium and ammonium chloride, which are soluble in alcohol and ether, are present in negligable traces. The method gives the free acid *plus* that united to proteïd. W. D. H.

Estimation of Sulphur in Cast-iron or Steel. By G. G. BOUCHER (*Chem. News*, 1896, **74**, 76).—Five grams of the iron or steel is dissolved in a strong solution of copper ammonium chloride; when the precipitated copper is dissolved, the solution is filtered, and the residue and paper, after washing free from copper with hot water, are boiled with about 30 c.c. of nitrohydrochloric acid or with bromine water and a few drops of hydrochloric acid. In the latter case, the excess of bromine is boiled off, the solution filtered, barium chloride added, and the barium sulphate collected, washed, ignited, and weighed. In the former case, the solution is filtered, neutralised with ammonia, slightly acidified with hydrochloric acid, treated with 5 grams of barium chloride, and so on. The results obtained with the process are satisfactory. D. A. L.

Estimation of Sulphur in Inorganic Sulphides. VI. By PAUL E. JANNASCH and O. HEIDENREICH (*Zeits. anorg. Chem.*, 1896, **12**, 358).—A sample of commercial mosaic gold (SnS_2) was analysed by heating 0·5 gram in a current of oxygen, and weighing the residual dioxide. The escaping gases were passed through either 3—4 per cent. aqueous hydrogen peroxide, or very dilute hydrochloric acid and bromine, and the sulphuric acid formed was precipitated and weighed as barium sulphate. The chloride was determined by digestion with very dilute nitric acid and precipitation with silver nitrate. Result: Sn 64·69, S 33·07, Cl 0·38, H_2O (lost at 95°) 0·29; total 98·43. The deficit is caused by the presence of oxysulphide in the sample.

C. F. B.

Precipitation of Barium Sulphate by means of Barium Chloride. By Georg Lunge (*Zeits. angw. Chem.*, 1896, 453).—A reply to Gladding (this vol., ii, 622). There is no necessity for conducting the precipitation of barium sulphate as recommended by that chemist. Excess of barium chloride added all at once gives a sufficiently pure precipitate. L. de K.

Estimation of Sulphuric Anhydride in Fuming Sulphuric acid. Estimation of Sodium Sulphide. By Paul Dobriner and Wilhelm Schranz (*Zeits. angw. Chem.*, 1896, 453—456).—*Estimation of Sulphuric Anhydride.*—The following process is recommended. The sample is introduced in the well-known manner into a drawn-out weighing tube, which, after the point has been sealed, is re-weighed. The tube is then put into a stoppered flask containing about 150 c.c. of distilled water, and on thoroughly shaking so as to break the tube, the sulphuric acid is dissolved by the water. A weighed quantity of pure sodium carbonate is now added, so as to nearly neutralise the solution, which is then boiled to expel the carbonic anhydride. Phenolphthaleïn is added, and the neutralisation completed by means of accurate normal soda, of which about 3 or 4 c.c. at most should be required. If the total acidity calculated as SO_3 equals A per cent., the excess of SO_3 is found by making use of the formula $\frac{49}{9}A - 444·44$. The method of simply titrating with normal soda is scarcely accurate within 1 per cent.; the author's modification yields almost scientifically accurate results.

Assay of Sodium Sulphide.—(a) Estimation of Sodium Sulphide in the Presence of Sodium Hydrosulphide.—Twelve grams of the sample is dissolved and made up to a litre. 25 c.c. of this solution is delivered from a burette into 45 c.c. of N/20 iodine, previously mixed with 10 c.c. of normal sulphuric acid and diluted to 150 c.c. The yellow colour should completely disappear; if not, the experiment should be repeated with less iodine solution. After adding starch water, the small excess of liberated hydrogen sulphide is titrated by means of the same iodine solution, and the total amount of hydrogen sulphide is found by an easy calculation. 6 grams of the sample is dissolved in water, decomposed with a known excess of normal sulphuric acid, boiled to expel hydrogen sulphide, and titrated with normal soda using phenolphthaleïn as indicator. This gives the sodium sulphide, which is then calculated to hydrogen sulphide and deducted from the total hydrogen sulphide. The difference is due to hydrogen sulphide existing as 2NaHS. This is now recalculated to

Na_2S, and this being deducted from the sodium sulphide found, gives the real amount of the latter.

(*b*) *Estimation of Sodium Sulphide in the Presence of Sodium Hydroxide.*—If free alkali is present, the amount of hydrogen sulphide found will be insufficient to account for all the soda calculated as Na_2S. The excess of soda is then calculated to sodium hydroxide.

L. DE K.

Gravimetric Estimation of Selenium. By A. W. PEIRCE (*Zeits. anorg. Chem.*, 1896, **12**, 409—412).—A portion of the sample containing from 0·2 to 0·4 gram of selenious anhydride is dissolved in hydrochloric acid, the solution, diluted to 400 c.c., is mixed with potassium iodide (the amount of which must be 3 grams in excess of the theoretical), and boiled for 10—20 minutes, until the red precipitate becomes black, and all free iodine is expelled. The precipitate is collected on an asbestos filter, washed, dried at 100°, and weighed. The results are fairly accurate, but always about 0·1 per cent. too high. It is essential that an excess of potassium iodide be employed, otherwise the precipitate will contain included iodine; also, the solution must be diluted before precipitation, or the precipitate will contain potassium iodide. If the selenium is present in a higher state of oxidation, the estimation is carried out in the same manner, but longer boiling is necessary. The method is very quick and convenient for determining the total percentage of selenium in a sample.

E. C. R.

Experiments on the Citrate-solubility of Basic Slags. By H. DUBBERS (*Zeits. angw. Chem.*, 1896, 468—473).—An exhaustive inquiry into Wagner's process. The author comes to the conclusion that the time of shaking with the ammonium citrate solution (half an hour) is quite insufficient, and that a larger quantity of acid ammonium citrate solution should be used. The author recommends using 500 c.c. of liquid, containing 10 grams of free citric acid and 5 grams of the same neutralised by ammonia. The shaking should be continued for about four hours. L. DE K.

Iodometric Estimation of Carbonic acid. By J. K. PHELPS (*Zeits. anorg. Chem.*, 1896, **12**, 431—435).—A weighed quantity of the carbonate is introduced into a flask connected with an absorption apparatus containing a solution of barium hydroxide; the apparatus is connected with an air pump, and the pressure diminished to 250—300 mm. The carbonate is then treated with a solution of phosphoric acid, previously boiled until free from carbonic anhydride, and the liberated carbonic anhydride is expelled into the absorption apparatus by five minutes boiling. The apparatus is cooled, and brought to atmospheric pressure, and the excess of barium hydroxide determined by adding an excess of iodine solution, boiling for a short time to decompose any hypoiodite which may be formed, and then determining the excess of iodine with a solution of arsenious acid. The solution containing the precipitated barium carbonate must be boiled before adding excess of iodine, as otherwise the iodine reacts slightly with the finely divided barium carbonate; after adding excess of iodine, the apparatus is connected with an absorption apparatus containing potassium iodide, to arrest any iodine which may volatilise, and to exclude air. The method is accurate and expeditious; one estimation is easily performed in three-quarters of an hour. E. C. R.

New Baryta Tube. By H. Chr. Geelmuyden (*Zeits. anal. Chem.*, 1896, **35**, 516—517).—When the carbonic anhydride in large volumes of air is to be estimated by Pettenkofer's method, the volume of the baryta solution may change during the absorption. A graduated baryta tube is therefore used, constructed on the pattern of a Gay-Lussac burette, but with the open end bent at a right angle to the main portion of the tube, which is laid in a nearly horizontal position whilst passing in the air through the narrow tube, but when raised into a vertical position allows the volume of the liquid to be read. M. J. S.

Separation of Silver from Gold by Volatilisation. By Joseph W. Richards (*Chem. News*, 1896, **74**, 2—3).—To separate silver from gold in assay buttons (obtained in the blowpipe assay), the button is supported in a hollow on a piece of dense charcoal, which must yield a white ash, and is exposed at an angle of 30° to a pointed needle-like oxidising flame directed downwards at an angle of 45°, precautions necessary to prevent displacement of the button by the blast. The button is heated at a redness, below the boiling point of silver, until it becomes brass-yellow, the temperature is then raised and taken almost to whiteness, when a gold colour is attained, this temperature being maintained until a distinct crimson coating is observed on the white ash; the amount of gold lost is negligable, but if the button is less than 0·25 mm. in diameter, a measured pure gold bead of almost equal size is added before the final stages of heating. The button is cupelled and measured. D. A. L.

Estimation of Magnesia as Magnesium Pyrophosphate. By Hugo Neubauer (*Zeits. angw. Chem.*, 1896, 435—440).—The composition of magnesium ammonium phosphate does not seem to be quite so constant as was formerly believed, as the precipitate often contains excess of phosphoric acid, which may be expelled by a prolonged ignition. In other cases, there may be an excess of magnesia.

To obtain correct results, the sodium phosphate should be added at once, in large excess, to the ammoniacal magnesia solution; it is better still to add it to the acid solution, and then to add the ammonia. Excess of ammonium salts does not hurt, but in presence of much ammonium oxalate the precipitate must, after slight washing, be redissolved in hydrochloric acid, and reprecipitated with ammonia and some more sodium phosphate. The precipitate should be ignited over the blowpipe, or a powerful bunsen burner, for at least half an hour, and, after weighing, it should again be heated, to see if there is any further diminution in weight.

When dealing with small quantities of magnesia only, there is no need for these precautions, but if the amount is large they should not be neglected. L. de K.

Volumetric Estimation of Zinc by means of Potassium Ferrocyanide. By LUCIEN L. DE KONINCK and EUGENE PROST (*Zeits. angw. Chem.*, 1896, 460—468; 564—572).—The authors have made an exhaustive investigation as to the various reactions which take place when potassium ferrocyanide is added to a zinc solution. The reaction takes place somewhat slowly; therefore there may, at first, be an excess of ferrocyanide as proved by the uranium reaction. Soon, however, this excess disappears as an insoluble double compound of zinc and potassium ferrocyanide is formed. The direct titration of zinc by means of potassium ferrocyanide is, therefore, not to be recommended. The following process is found by the authors to give trustworthy results: 10 grams of pure zinc is dissolved in hydrochloric acid, nearly neutralised with soda, and made up to 1 litre. 27 grams of potassium ferrocyanide is dissolved in a litre of water. When checking, 20 c.c. of the zinc solution is mixed with 50 c.c. of a 20 per cent. solution of ammonium chloride, 2 drops of a 10 per cent. solution of sodium sulphite, and 10 c.c. of hydrochloric acid (sp. gr., 1·075); the zinc solution must be measured from an accurate pipette, but the others are only roughly measured. 40 c.c. exactly of the ferrocyanide solution is now added, and, after being left for at least 10 minutes, the excess is titrated with the zinc solution until the uranium reaction is no longer obtained. The relation between the zinc and the ferrocyanide is thus determined.

The estimation of zinc in any of its ores is now very simple. 2·5 grams of the sample is dissolved in nitrohydrochloric acid and evaporated to dryness to render any silica insoluble, the residue being taken up with 5 c.c. of hydrochloric acid and a little water. The filtrate is freed from lead, cadmium, &c., by a current of hydrogen sulphide, boiled to expel the gas, and, after cooling, mixed with 25 c.c. of saturated bromine water. After pouring the liquid into a 500 c.c. flask, containing 100 c.c. of strong ammonia and 10 c.c. of a 25 per cent. solution of ammonium hydrogen carbonate, it is, when cold, made up to the mark.

When the precipitate has quite settled, the liquid is passed through a dry filter. 100 c.c. is then pipetted off, acidified with hydrochloric acid, and titrated with the ferrocyanide in the way described. L. DE K.

Separation of Mercury from Arsenic, Antimony, and Copper by Ignition in a Current of Oxygen. By PAUL E. JANNASCH (*Zeits. anorg. Chem.*, 1896, **12**, 359—364; compare this vol., ii, 546). —Mercury can be separated from antimony by oxidising the mixed sulphides with fuming nitric acid, driving off the excess of acid by heating first at 90—100°, then at 150—180°, in a current of air or carbonic anhydride, and finally igniting in a current of oxygen. The antimony remains as the oxide, Sb_2O_4, and is weighed as such. The mercury that volatilises is collected in vessels containing dilute nitric acid, and is estimated as described previously; the addition of a little hydrogen peroxide promotes the solution of the metal in the acid.

Mercury can be separated from copper by igniting the mixed sulphides in a current of oxygen. The mercury volatilises, and is collected in vessels containing dilute nitric acid and bromine water; the solution is evaporated almost to dryness, the reidues treated with hydrochloric acid and water, and the mercury precipitated and weighed as sulphide. The copper remains in the vessel as oxide after the ignition, and may be weighed as such, or it may be dissolved in acid and precipitated with sodium hydroxide.

Mercury can be separated from arsenic by evaporating the solution in nitric acid, moistening the residue with water, and adding a little pure magnesia, drying at 180°, and then igniting in a current of oxygen. The mercury volatilises and is collected in vessels containing dilute nitric acid and hydrogen peroxide, and estimated in the solution thus obtained. The residue is dissolved in strong hydrochloric acid, some citric acid is then added, and a large excess of ammonia; the precipitate which forms is converted into magnesium pyroarsenate, and weighed as such. C. F. B.

Estimation of Nickel in Steel, &c. By H. BREARLEY (*Chem. News*, 1896, **74**, 16—17).—A gram of steel is dissolved in 20 c.c. of nitric acid (sp. gr., 1·2), in a 1100 c.c. beaker, cooled, treated with dilute ammonia to slight precipitation, then with hydrochloric acid until again clear; to this are added 70 c.c. of strong acetic acid, 950 c.c. or so of hot water, and 50 to 70 c.c. of ammonium acetate made by neutralising acetic acid with ammonia. The whole is boiled and made up to a litre, and half this is filtered hot, cooled, rendered alkaline with ammonia, and mixed with 2 c.c. of a solution containing 20 grams of potassium iodide per litre, and 2 c.c. of a solution containing 2·5 grams of silver nitrate per litre; a solution of potassium cyanide (4·5 grams per litre, and standardised against standard nickel) is then run in until the silver iodide dissolves and the solution is clear. Tungsten and manganese do not interfere, and the coloration, due to chromium, is overcome by boiling the iron precipitate for half an hour. Copper has to be separated from the solution containing it and the nickel by means of sulphurous acid and thiocyanate.

With regard to procedure, adding the acetate to the hot solution is advantageous, since, in the presence of 70 to 100 c.c. of acetic acid, the precipitate does not appear before 85—90°, but immediate precipitation should be avoided, as it causes low results. For filtering, fibrous asbestos, on a perforated plate 1½ inch in diameter, is found expedient; the tip of the funnel used must be flat, and until in use the space below the perforated plate must be kept full of water, which is completely displaced by the first 300 c.c. of solution.

D. A. L.

Standardisation of Permanganate. By E. RIEGLER (*Zeit. anal. Chem.*, 1896, **35**, 522).—The chief objection to keeping a standard solution of oxalic acid in readiness for the titration of permanganate is that it does not remain unaltered in strength. This may be overcome by the addition of a sufficient quantity of sulphuric acid. A solution containing 9·9654 grams of oxalic acid and 50 c.c. of concentrated sulphuric acid in the litre underwent no change in strength in the course of a year. M. J. S.

Examination of Commercial Thorium Nitrate and Separation of Thorium from Cerium. By C. REMIGIUS FRESENIUS and E. HINTZ (*Zeits. anal. Chem.*, 1896, **35**, 525—544).—The authors having analysed, by methods which they propose to publish later, 11 specimens of mantles for incandescent gas illumination, produced by different makers between March and October, 1895, in which thorium and cerium oxides were the principal constituents, were further required to give an opinion whether the cerium oxide present might be regarded as an impurity resulting from the methods of manufacture in use at that time, or had been intentionally added. The percentage of cerium oxide found in the mantles ranged from 0·38 to 2·02 (average 1 per cent.). Having obtained three samples of thorium nitrate which had been sent into the market during the period in question, one of which had been prepared from monazite, which contains only 4—5 per cent. of thoria, with 50—60 per cent. of oxides of the cerium metals, the percentage of cerium was estimated as follows. The dilute solution (1 per cent. or less) of the nitrate was precipitated by boiling with thiosulphate, and the precipitate dissolved in hydrochloric acid and thrown down by ammonia. The original filtrate was also precipitated by ammonia. The two precipitates were dissolved in hydrochloric acid and both solutions again submitted to the thiosulphate precipitation, this treatment being repeated several times. Finally, the ammonia precipitate from the filtrates was dissolved in nitric acid, and, after driving off the excess of acid, the cerium, yttrium, lanthanum, and neodymium were precipitated by oxalic acid. The ignited precipitate was fused with potassium hydrogen sulphate, again precipitated by ammonia, and dissolved in hydrochloric acid. Cerium was now thrown down alone by the addition of sodium acetate and hypochlorite, this precipitation being repeated a second time. Lastly, the oxide was dissolved in nitric acid, thrown down by ammonia, washed, ignited, and weighed. Yttrium and neodymium (including lanthanum) were separated by saturated potassium sulphate solution. Thorium was in all cases found by difference. The cerium oxide found in the three samples was 0·186, 0·0463, and 0·202 per 100 parts of total oxides, and, since the highest of these is only about one-half of the lowest amount, or one-fifth of the average amount, found in the mantles, the authors conclude that the cerium oxide there present had either been purposely added, or resulted from the use of a thorium salt of less purity than was commercially attainable at that time. As a further proof that the methods known to chemists in 1895 were capable of effecting a far greater degree of separation than was found in the mantles, mixtures of cerium and thorium salts were prepared, containing respectively 2·02 and 0·38 per cent. of cerium oxide. By three precipitations with thiosulphate, and a subsequent precipitation by oxalic acid, there were recovered 98 and 96·6 per cent. of the cerium taken, the precipitates containing only 0·7 and 0·3 per cent. of thoria respectively.

M. J. S.

Separation of Bismuth from the Metals of the Copper and Iron Groups by heating their Salts in a Current of dry Hydrogen Chloride. By PAUL E. JANNASCH and S. GROSSE (*Zeits.*

anorg. Chem., 1896, **12**, 398).—Bismuth, like tin (Abstr., 1895, ii, 462), volatilises under these circumstances at a comparatively low temperature, and so can be separated from metals the chlorides of which are less volatile. C. F. B.

Estimation of Ethylene in Gaseous Mixtures. By P. FRITZSCHE (*Zeits. angw. Chem.*, 1896, 456—459).—The process is based on the fact that ethylene is completely absorbed by strong sulphuric acid, and that this solution, when diluted with twice its bulk of water and submitted to distillation, yields the quantitative amount of alcohol.

When operating on mixtures rich in ethylene, the process scarcely gives any trouble, but when the gas is present in traces only it is not so simple. In this case, a large quantity of the gaseous mixture is introduced in a glass apparatus containing a little sulphuric acid, which is continually allowed to run over the sides, so as to offer a large surface to the gas. To accelerate the absorption, the apparatus is heated in an air bath at 100°. After diluting the acid and distilling, the distillate is neutralised with soda and again submitted to distillation; this has to be repeated until the amount of alcohol reaches about 1—2 per cent. It is then estimated, as usual, by taking the specific gravity of the liquid.

Any butylene may be first separated from the ethylene by the action of sulphuric acid of 70 per cent., which does not affect the ethylene. Experiments conducted with the idea of converting the ethylene into ethylic barium sulphate, and estimating this volumetrically, have not, as yet, yielded satisfactory results. L. DE K.

Estimation of Essential Oil of Mustard in Feeding Cakes. By MAX PASSON (*Zeits. angw. Chem.*, 1896, 422—423).—Twenty-five grams of the sample is introduced into a flask containing 300 c.c. of water and 0·5 gram of tartaric acid. The flask, which is provided with a safety tube, is connected with a smaller flask containing 75 c.c. of glacial acetic acid and a little zinc and iron dust, to effect a partial reduction of the ethereal oil. To prevent any escape of the latter, the second flask is fitted with a bent tube dipping into sulphuric acid contained in a beaker.

The mixture is slowly distilled for about two hours, and then the acetic and sulphuric acids are mixed. An aliquot part of the mixture is boiled with an equal bulk of sulphuric acid and a drop of mercury to convert the nitrogen into ammonia, which is then estimated as usual.

One c.c. of N/10 soda represents 0·0099 gram of essential oil of mustard (allylthiocarbimide). Test experiments with small quantities of the pure oil were quite satisfactory. L. DE K.

Estimation of Sugar in Blood. By E. WAYMOUTH REID (*J. Physiol.*, 1896, **20**, 316—321).—In the method described, phosphotungstic acid is used as the precipitant for proteïd; this is filtered off and washed by the use of a filter plate, and the sugar estimated by the Allihn-Soxhlet gravimetric process. The results obtained show that the method is both accurate and rapid. W. D. H.

Messinger's Method of Estimating Acetone. By H. Chr. Geelmuyden (*Zeits. anal. Chem.*, 1896, **35**, 503—516).—The author, desiring to employ Messinger's method (Abstr., 1889, 313; 1891, 370) for the estimation of acetone in the breath of animals and in urine, examined by means of test-analyses the influence of the various modifications which the circumstances necessitated. Collischonn's statement that a mixture of iodine and alkali hydroxide soon loses the power of converting acetone into iodoform is amply confirmed. Such a solution cannot, therefore, be employed for absorbing acetone from the products of respiration. By passing the gases through strong potash alone, all the carbonic anhydride and part of the acetone were absorbed. The gases were then conducted over ignited cupric oxide, and the carbonic anhydride produced was absorbed in a special form of Pettenkofer's tube (see this vol., ii, 674). Blank experiments showed that the air from the lungs of animals contained no other volatile organic substance, and test experiments in which known quantities of acetone were volatilised in the empty live cage yielded results within 10 per cent. of the truth. Since this method required the use of very strong potash solution (40 per cent.), the influence of this high strength on the estimation was examined, and it was found that no loss of acetone occurred when it was kept dissolved in such potash for 24 hours before titration, but that it was necessary to dilute the solution with 2—3 vols. of water before adding iodine, otherwise the formation of iodoform was so instantaneous that some iodine became enclosed. In carrying out the Messinger-Huppert method for estimation in urine, some loss is inevitable; this amounted on an average to 6·75 per cent. when the distillate was cooled with ice, and to 8·3 per cent. when water of a few degrees above zero was used. Acetone solutions of very low temperature do not, however, react completely with iodine, especially when the alkali present is greatly diluted. The temperature should, therefore, be raised to 18—20° by addition of hot water or hot potash just before the iodine. The distillation should be carried nearly to dryness, the end of the condenser tube dipping into the potash in the receiver. A small correction is required for some volatile substance which distils from normal urine and consumes iodine, although it produces no iodoform. In human urine, amounts varying from 0·58 to 1·35 (calculated as milligrams of acetone) per 100 c.c. were found. The addition of urea should be avoided, unless nitrites are present, since it lowers an already deficient yield. M. J. S.

Examination of Oil of Bergamot. By Arthur Bornträger (*Zeits. anal. Chem.*, 1896, **35**, 523—525).—The discrepancy between the percentages of linalyl acetate found by Schimmel and Co., and the author respectively (this vol., ii, 228) seems to have been due to differences in the ripeness of the fruit from which the oil was obtained. Five samples of oil prepared by simple pressure from sound, ripe fruit gave the limits 38·5—42 per cent. Later estimations by Schimmel and Co. in last seasons oil have given an average of 37 per cent., the oil from unripe fruit showing only 33—34 per cent., and a few specimens towards the close of the season exhibiting 40 per cent. and upwards (44 per cent.). The product of the season was, however, of low quality. M. J. S.

Simple Process for Testing Linseed Oil, Boiled Oil, and Paints. By Rudolf Hefelmann and Paul Mann (*Chem. Centr.*, 1896, i, 133: from *Pharm. Central-Hall.*, **36**, 685—688).—The chief adulteration practised is the addition of rosin oil, rosin, or rosin soap; mineral oil is also frequently used. The authors find that these frauds may be readily detected by the butyro-refractometer. Pure oil and boiled oil, which at 25° give a refraction of 80—84·5, show, on mixing with 20 per cent. of rosin or rosin oil, a refraction above 100. Mineral oils also cause a higher refraction. The polariscope may also be used, as rosin oil will cause a strong right-handed, and rosin, a slight right-handed polarisation, whilst mineral oil causes a slight left-handed polarisation. The experiment is carried out by shaking 15 c.c. of the sample with 15 c.c. of absolute alcohol; the alcoholic layer is poured off, mixed with a little chloroform, filtered, and then polarised. When testing paints, 2—5 grams of the sample is treated with 20 c.c. of light petroleum, and, after whirling in a centrifugal apparatus, the liquid is poured off, evaporated, and the oil, after drying at 100°, is tested in the refractometer. L. de K.

Iodine Number of Pure and Boiled Linseed Oil. By Alexander Katz (*Chem. Centr.*, 1895, ii, 463; from *Forsch. Ber. Lebensm. Hygiene*, **2**, 203—204).—The iodine number depends on the time during which the Hübl solution is allowed to act, but remains constant after 24 hours. The action should be allowed to take place in the dark. The average iodine number of raw linseed oil is 182; that of boiled oil 173. L. de K.

Iodine Number of Cacao Butter. By F. Filsinger (*Zeit. anal. Chem.*, 1896, **35**, 517—521).—The wide limits, 32·8 to 41·7, assigned by Strohl (this vol., ii, 506) induced the author to recall the results obtained in 1889 by himself and Henking in the examination of all the varieties of raw cacao in use in Germany, 18 in number (compare Abstr., 1891, 869). All the results lay between 33·4 and 37·5, and these limits have been fully confirmed by more recent experience. It is suggested that the fat in Strohl's specimens, some of which were several years old, may have become decomposed with liberation of free acids, which, as is well-known, absorb more iodine than the neutral fats. Strohl's samples having been wholly consumed, no re-examinaton is possible. M. J. S.

Extracting Fat from Cheese for Testing Purposes. By Otto Henzold (*Chem. Centr.*, 1896, i, 140—141; from *Milch Zeit.*, **24**, 729—730).—Three hundred grams of the sample of cheese, cut up into little dice, is shaken in a wide necked flask with 700 c.c. of

5 per cent. aqueous potash heated to 22°. After about 10 minutes, the caseïn has dissolved, and the fat floats on the surface. It is then removed, washed, melted, filtered through a small filter, and submitted to the usual tests. L. DE K.

New Method for Quantitative Isolation of Alkaloïds. By KARL KIPPENBERGER (*Zeit. anal. Chem.*, 1896, **35**, 407—421).—In continuation of his work on the detection of poisonous alkaloïds in cadaveric matter (Abstr., 1895, ii, 465; this vol., 282), the author has developed a method of obtaining the pure alkaloïds from their periodides. He first shows that by precipitating neutral, or feebly alkaline solutions with the iodine reagent, the precipitate is free from ptomaines or other normal constituents of an extract of cadaveric matter. Having, therefore, obtained an extract which may contain these substances, it is acidified and heated to coagulate albumin, then neutralised or rendered feebly alkaline, and precipitated by an iodine solution containing 12·7 grams of iodine and 60 grams of potassium iodide per litre. The precipitate is collected on an asbestos filter, washed thoroughly with cold water, and dissolved in a small quantity of purified acetone, in which menstruum all the alkaloïd periodides are freely soluble. On treating the acetone solution with an alkaline hydroxide, and then acidifying with hydrochloric acid, the alkaloïd is converted into its hydrochloride, with liberation of iodine, the latter, after warming to expel acetone, being removed by the addition of thiosulphate. Excess of sodium carbonate is then added, and the alkaloïd extracted by shaking with chloroform (in some cases a mixture of chloroform and ether; in others, morphine and narceïne, chloroform and alcohol). The chloroform solution leaves the pure alkaloïd on evaporation, but as an uncertain amount of water of crystallisation may be present in the residue, the weight requires to be confirmed by some form of titration (see next abstract, also 1895, ii, 467). The behaviour of morphine is peculiar. On gradually adding the iodine solution to a morphine salt supersaturated with alkali, a grass-green colour is obtained before any precipitate is produced. This seems to be due to a partial oxidation of the morphine to oxydimorphine, and is characteristic of that alkaloïd.

A similar method can be applied to the preparation of the pure alkaloïds from plant extracts. After treating the acetone solution with alkali and acid as above, and before adding thiosulphate, the whole is shaken with petroleum, of boiling point 30—50°, by which certain impurities are removed. This branch of the subject the author proposes to study more minutely.

The tendency, which most alkaloïds exhibit, to turn brownish when their ethereal solutions are evaporated and the residue is dried on the water bath, can be completely counteracted by the presence of a little alkali carbonate, and the trace of this salt, which ether is capable of dissolving, suffices for the purpose. Sodium carbonate is, therefore, to be preferred to ammonia for the liberation of an alkaloïd from its salts.

A common method for recovering an alkaloïd from its ethereal solution is to convert it into a salt by adding an acid, but since the ethereal solutions obtained from cadaveric matter are very liable to contain ammonia, as well as amido-bases and acids, the salts of these substances separate simultaneously. As, however, none of these give precipitates with iodine, the use of the iodine method is here very advantageous. M. J. S.

Titration of Alkaloïds by Iodine Solution. III. By KARL KIPPENBERGER (*Zeit. anal. Chem.*, 1896, **35**, 422—471).—As indicated in the earlier papers on this subject (Abstr., 1895, ii, 467; this vol., 282) the amount of free iodine consumed, when a solution of iodine in potassium iodide reacts with a salt of an alkaloïd to form periodide, is always greater than corresponds with the equation $\mathrm{Alk,HCl + KI + I_2 = Alk,IH,I_2 + KCl}$, and varies considerably not only with the different alkaloïds, but with varying conditions of the experiment. Attempts to produce the alkaloïd hydriodides by treating the hydrochlorides (or sulphates) with various metallic iodides (ammonium, magnesium, or barium), either before, or simultaneously with the addition of the iodine reagent, led to no greater uniformity in the results, and the same was the case when the amount of free acid (whether hydrochloric, hydrobromic, or hydriodic) in the alkaloïd solution was increased. The addition of haloïd salts had in general the same effect, although with brucine the addition of a considerable amount of potassium iodide, or with morphine, of bromide, reduced the amount of iodine consumed to the theoretical 2 atoms. Finally, however, the following method was found to be applicable to all the alkaloïds examined (brucine, morphine, atropine, narcotine, quinine). The alkaloïd is dissolved in the smallest possible excess of a standard acid (hydrochloric or sulphuric) avoiding dilution as far as possible. There is then added a solution of silver iodide in potassium iodide prepared by dissolving 1 gram of silver nitrate, and 10 grams of potassium iodide in 20 c.c., and employing only so much of this reagent as is exactly equivalent to (or very slightly in excess of) the acid used. Thus, for 0·1 gram of hydrogen chloride there would be used $20 \times 0{\cdot}1 \times 170/36{\cdot}5 = 9{\cdot}32$ or 9·4 c.c. Should a greater excess of the silver solution have been added, and a double salt of the alkaloïd and silver have thereby been precipitated, this injurious effect can be counteracted by adding more potassium iodide, and waiting until the precipitate is redissolved. Iodine solution (N/20) is then added in the smallest possible excess. The formation of the alkaloïd periodide is complete in 2—3 minutes. The liquid is poured through an asbestos filter, and the excess of iodine in an aliquot part of the filtrate is estimated by N/20 thiosulphate. Using thiosulphate of this strength, there is no risk of forming silver thiosulphate. One molecule of alkaloïd consumes exactly 2 atoms of iodine, except in the case of quinine, where the tendency to the formation of diacid salts is exemplified by the consumption of 4 atoms. M. J. S.

Testing Cinchona Extract. By MARIUS L. Q. VAN LEDDEN HULSEBOSCH (*Chem. Centr.*, 1896, i, 141—142; from *Ber. pharm. Ges.*, 1895, 286).—One gram of the sample is dissolved in a small beaker in 5 c.c.

of water and 5 drops of normal hydrochloric acid. After pouring it into the author's extraction apparatus, which is a kind of Soxhlet's tube, the beaker is rinsed twice with 5 c.c. of water, and the liquid is then extracted with ether for an hour. After adding 2 c.c. of normal soda to liberate the alkaloïds, the extraction is repeated, and, after evaporating off the ether in a tared flask, the alkaloïds are dried at 100° and weighed.

To estimate the amount of cinchona tannates, 10 grams of the liquid extract is introduced into a tared narrow beaker, and mixed with 10 c.c. of a 20 per cent. solution of sodium acetate. The turbid mixture is heated on the water bath until the tannate has agglomerated and coated the sides of the beaker. The liquid is poured off, the deposit washed with a very little water, dried at 100°, and weighed. L. DE K.

Reactions of Digitalin. By C. C. KELLER (*Chem. Centr.*, 1896, i, 132; from *Ber. pharm. Ges.*, 1895, 275).—Commercial digitalin contains four active constituents: Digitonin, a glucoside yielding, on hydrolysis, digitogenin, glucose, and digitalose; digitaleïn, an amorphous glucoside, yielding digitaligenin, glucose, and digitalose; digitaleïn, a crystallised glucoside, yielding products not yet investigated, and digitoxin, a bitter principle. The author has discovered delicate colour reactions for these four substances. The sample is dissolved in 3—4 c.c. of glacial acetic acid, a drop of dilute ferric chloride is added and then an equal bulk of sulphuric acid, without shaking. The colour generated at the place where the two layers touch is carefully observed. Digitonin gives a faint rose-red, evanescent, colour. Digitalin gives a bright carmine-red colour, very permanent, still visible with 0·05 milligram per c.c. Digitaleïn gives a similar colour but less distinct and not so permanent. The test with digitoxin is very characteristic. The result is a dirty bluish-green ring, which soon breaks up into two layers, the bottom one of which is brownish-red, whilst the top assumes an indigo-blue colour. L. DE K.

Chemical Examination of Cheese. By ALBERT STUTZER (*Zeit. anal. Chem.*, 1896, **35**, 493—502).—For all the estimations, except that of ash, a mixture should be prepared by triturating the cheese with four times (or in the case of soft cheese, five times) its weight of washed, ignited, and sifted quartz sand. The ash, water, fat, and total nitrogen are estimated by the usual processes of incineration, drying at 100°, extracting the dried residue with ether, and the Kjeldahl process respectively. For the distillation of the ammonia, barium carbonate is a safer form of alkali than magnesia or magnesium carbonate. Nitrogenous compounds (other than ammonia), which are not precipitable by phosphomolybdic acid from a cold, aqueous extract of the cheese, are set down as amides. For experiments on the digestibility of cheese, a stock of pepsin solution is prepared as follows:—The mucous membranes of six fresh pig's stomachs are cut up small, and extracted for 24 hours with 30 litres of 0·2 per cent. hydrochloric acid, 15 grams of thymol, dissolved in alcohol, being added as a preservative. The liquid is then strained (without squeezing) through a flannel bag, and filtered, first through loose, then through dense, filter paper. It retains its activity for several months. To estimate the total digestible constituents, a quantity of the sand mixture containing 5 grams of cheese is freed from fat by ether, and then digested for 48 hours at 37—40° with 500 c.c. of this extract, adding every two hours 5 c.c. of 10 per cent. hydrochloric acid until a total acidity of 1 per cent. is reached. The indigestible residue is then collected on an asbestos filter, and its nitrogen estimated. For albumose and peptone, the cheese is exhausted by boiling with 100 parts of water (in five portions), and one part of the cooled and filtered extract is acidified with sulphuric acid, and precipitated by phosphomolybdic acid. Another part of the extract is concentrated and saturated with zinc sulphate (see this vol., ii, 83), and the filtrate is tested for pancreas peptone by adding strong soda solution until the zinc oxide is redissolved, and then a few drops of 1 per cent. copper sulphate solution (the biuret reaction). The amount of peptone is calculated from the difference between the nitrogen in the phosphomolybdic and zinc sulphate precipitates. Deducting the soluble and the indigestible nitrogen from the total nitrogen, the remainder gives the caseïn and albuminates, or these may be directly, but less conveniently, estimated in the residue of the extraction with hot water. It is advisable further to estimate the digestibility of the cheese by submitting it to a process of interrupted digestion. A quantity of the sand mixture (in this case not freed from fat), containing 0·15 gram of nitrogen in the form of insoluble, but digestible caseïn and albumin, is treated with 150 c.c. of the pepsin solution and 350 c.c. of water containing 0·7 gram of hydrochloric acid, both liquids being warmed to 40° before adding, and the mixture being maintained at the same temperature for 30 or 60 minutes, stirring every five minutes. At the end of the given period, the whole is poured into two large, rapid, ribbed filters, and a portion of the filtrate collected in the first five minutes is used for the nitrogen determination. M. J. S.

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  Acetic-α-sulphonepropionic acid.
  Acetic-β-sulphonepropionic acid.
  Acetoacetic acid.
  Acetoacetic acid, cyan-.
  Acetochloropyridinecarboxylic acid, dichlor-.
  Acetomenthoximic acid.
  Acetonedicarboxylic acid.
  Acetonylmalic acid.
  Acetonylsuccinic acid.
  Acetopicolinic acid.
  Acetoxycamphanic acid.
  Acetylallophanic acid.
  γ-Acetylbutyric acid.
  Acetylcallitrolic acid.
  Acetyldicyanacetic acid.
  Acetylenedicarboxylic acid.
  Acetyl-d-lactic acid.
  Acetylmalic acid.
  Acetylmalonic acid.
  Acetylmandelic acid.
  Acetylphenylmalic acid.
  Acetylsandaracolic acid.
  Acetylsantonic acids.
  Aconitic acid.
  Acrylic acid.
  Allylacetic acid.
  Allylmalonic acid.
  Allylpropanetricarboxylic acid.
  Amylacetic acid.
  3′-Amyl-2′-hexylquinoline-1-carboxylic acid.
  iso-Amylmalonic acid.
  Amylsulphamic acid.
  Anemonin.
  Anhydracetonebenzilcarboxylic acid.
  Anhydrocamphoic acid.
  Anhydrocamphoronic acid.

Acids. See :—
Anhydrodibenzylacetoacetic acid.
Anhydrotetronic acid.
Anilidobenzoic acid.
β-Anilidopropionic acid.
Aniline-*o*-sulphonic acid.
Aniline-*m*-sulphonic acid.
Anisic acid.
Anisoilphthaloylic acid.
Anisoylcarboxylic acid.
Anisoylglyoxylic acid.
Anisuric acid.
Anthraquinonecarboxylic acid.
Apioleketonic acid.
Apiolic acid.
Apophyllenic acid.
Arabonic acid.
Arachidic acid.
Aristidinic acid.
Aristinic acid.
Aristolic acid.
Aristolochic acid.
Aspartic acid.
Atranoric acid.
Azelaic acid.
Azimidobenzoic acid.
Azimidoethylenedicarboxylic acid.
Azimido-*m*-uramidobenzoic acid.
Azimido-*p*-uramidobenzoic acid.
Azinemethanedisulphonic acid.
Azoacetic acid.
Azurilic acid.
Behenoxylic acid.
Benzaldoximidoacetic acid.
iso-Benzaldoximidoacetic acid.
Benzamidosulphonic acid.
Benzeneazocyanacetic acid.
Benzeneazosalicylic acid.
Benzenediazosulphonic acid.
Benzenesulphinic acid.
Benzenesulphonic acid.
Benzilic acid.
Benzoic acid.
Benzoindicarboxylic acid.
Benzothiazolecarboxylic acid.
Benzoylacethydroxamic acid.
Benzoylacetic acid.
Benzoylallophanic acid.
Benzoylbenzoic acid.
p-Benzoylbenzoic acid.
p-Benzoyl-*p*-benzoylbenzoic acid.
Benzoyl-*o*-ethoxybenzoic acid.
Benzoylethylnitrolic acid.
Benzoylglutaric acid.
Benzoylglyceric acid.
Benzoylhydrazoneacetoacetic acid.
Benzoylphthalic acid.
Benzoyl*iso*phthalic acid.
Benzoylpropionic acid.
Benzoylsalicylic acid.
Benzoylsandaracolic acid.
Benzoyl-*d*-santonous acid.

Acids. See :—
Benzoylsantonous acid, racemic.
Benzoyltetronic acid.
Benzoyltoluic acids.
α-Benzoyltricarballylic acid.
β-Benzylcrotonic acid.
β-Benzyl-*iso*-crotonic acid.
Benzyldesmotroposantonous acid.
Benzylideneacetoacetic acid.
Benzylideneaminophenylimido-β-butyric acid.
Benzylidenehydrazido*iso*butyric acid.
Benzylidenehydrazinecarboxylic acid.
Benzylmalonic acid.
β-Benzyloxycrotonic acid.
l-Benzylsantonous acid.
Benzyl-*o*-sulphamidobenzoic acid.
Brassylic acid.
cyclo-Butane-1 : 3-dioxalylic acid.
αγγ-Butanetricarboxylic acid.
iso-Butylanhydrodibenzilacetoacetic acid.
Butyric acid.
iso-Butyric acid.
Butyrophenone-*o*-carboxylic acid.
Butyroylmalic acid.
iso-Butyroylmalic acid.
iso-Butylmalonic acid.
Callitrolic acid.
Camphanic acid.
cis-*π*-Camphanic acid.
Camphenephosphonic acid.
Camphenesulphonic acid.
Camphenylic acid.
Camphoic acid.
Campholenic acid.
Campholic acid.
allo-Campholytic acid.
cis-Campholytic acid.
Camphopyranilic acid.
Camphopyric acid.
Camphoramic acid.
Camphorenic acid.
Camphoric acid.
Camphoronamic acid.
Camphoronic acid.
iso-Camphoronic acid.
Camphoronimic acid.
Camphorsulphonic acid.
Camphotricarboxylic acid.
Caproic acid.
Carbethoxyacethydroxamic acid.
Carbethoxyethylnitrolic acid.
4-Carboxamidobenzoic acid, 3-amino.
Carboxyacetonylsuccinic acid.
Carboxyethylthiocarbamic acid.
Carboxyphenylmalonic acid.
Cardenic acid.
Cardic acid.
Cardolic acid.
Carnaubic acid.
Carnic acid.

Acids. See :—
- Caronebisnitrosylic acid.
- Cerotic acid.
- Chironolic acid.
- Chloralic acid.
- *d*-Choleic acid.
- Cholic acid.
- Chromoxalic acid.
- Cincholeuponic acid.
- Cinchomeronic acid.
- *iso*-Cinnamenylmandelic acid.
- Cinnamic acid.
- Citraconic acid.
- Citradibromopyrotartranilic acid.
- Citrazinic acid.
- Citric acid.
- Citronellic acid.
- Columbic acid.
- Crotonic acid.
- *iso*-Crotonic acid.
- *iso*-Coumarincarboxylic acid.
- Cumenesulphonic acid.
- Cuminic acid.
- Cyanacetic acid.
- Cyanuric acid.
- *iso*-Cyanuric acid.
- Cymenecarboxylic acid.
- Cymenesulphonic acid.
- Cymylglyoxylic acid.
- Decoic acid.
- Deoxyamalic acid.
- Deoxycholeic acid.
- Desmotropodisantonous acid.
- Desmotroposantonous acid.
- Desoxalic acid.
- Desylacetic acid.
- Desyleneacetic acid.
- Diacetoacetic acid.
- Diacetylglyceric acid.
- Diacetyltartaric acid.
- Diallylacetic acid.
- Dialuric acid.
- Diaminobenzenesulphonic acid.
- Diazoacetic acid.
- Diazoaminosulphanilic acid.
- Diazobenzenephenylhydrazonemethanedisulphonic acid.
- *p*-Diazobenzenesulphonic acid.
- *iso*-Diazobenzenesulphonic acid.
- Diazomethanedisulphonic acid.
- Diazoniumanthranilic acid.
- Diazophenolcarboxylic acid.
- Diazophenolsulphonic acid.
- Diazosalicylic acid.
- Diazosulphanilic acid.
- Dibenzamidodianilidosuccinic acid.
- Dibenzenesulphonhydroxylamic acid.
- Dibenzoylacetohydroxamic acid.
- Dibenzoylbenzhydroxamic acid.
- Dibenzoylbenzoic acid.
- Dibenzoylglyceric acid.
- Dibenzoylphenylacetic acid.

Acids. See :—
- Dibenzoyltartaric acid.
- Dibenzylacetic acid.
- Dibenzylacetoacetic acid.
- Dibenzylcyanoacetic acid.
- Dibenzylmalonic acid.
- Dicarboxyphenylglyoxylic acid.
- Didehydroketocampholenic acid.
- 2 : 4-Diethoxybenzoic acid.
- 2 : 4-Diethoxybenzoylformic acid.
- Diethoxybutyric acid.
- 2 : 4-Diethoxymandelic acid.
- Diethoxyquinonedimalonic acid.
- Diethoxysuccinic acid.
- Diethylaminohexahydrotoluic acid.
- *exo*-Diethylamino-*o*-toluic acid.
- *exo*-Diethylamino-*p*-toluic acid.
- Diethyldicarboxyglutaric acid.
- *αα*-Diethylglutaric acid.
- Diglycollic acid.
- Dihydracrylic acid.
- Dihydro-*cis*-campholytic acid.
- Dihydrocumic acid.
- Dihydrophthalic acid.
- Dihydropolystichic acid.
- Dihydroxyadipic acid.
- Dihydroxydimethylglutaric acid.
- Dihydroxydiphenylaminecarboxylic acid.
- Dihydroxydiphenylglutaric acid.
- Dihydroxymaleic acid.
- Dihydroxynaphthalenesulphonic acid.
- Dihydroxynaphthoic acid.
- 2 : 6-Dihydroxypyridine-4-carboxylic acid.
- Dihydroxystearic acid.
- Dihydroxysulphonaphthoic acid.
- Dihydroxytetraphenylethanedicarboxylic acid.
- Diketotrahydroquinazoline-2-carboxylic acid.
- Dilactylic acid.
- 2 : 3-Dimethoxybenzoic acid.
- 3 : 4-Dimethoxybenzoic acid.
- Dimethoxytriphenylcarbinolcarboxylic acid.
- Dimethoxytriphenylmethanecarboxylic acid.
- Dimethylacrylic acid.
- Dimethylanilinesulphonic acid.
- Dimethylapionolcarboxylic acid.
- Dimethylazammoniumbenzoic acid.
- Dimethylbenzoic acid.
- Dimethylbenzoylpropionic acid.
- Dimethylcarballylic acid.
- *αα*-Dimethylcyanosuccinic acid.
- Dimethylcyanuric acid.
- Dimethylenegluconic acid.
- Dimethylethylsuccinic acid.
- Dimethylfumaric acid.
- *αα*-Dimethylglutaric acid.
- *αβ*-Dimethylglutaric acid.

Acids. See :—
Dimethylmaleic acid.
Dimethylmalonic acid.
Dimethylnaphthaquinonepropionic acid.
Dimethyloctanoloic acid.
2 : 6-Dimethyloctane-3-onoic acid.
2 : 6-Dimethyl-3-oximidoctanic acid.
2 : 6-Dimethylpiperidine-3 : 5-dicarboxylic acid.
Dimethylpropanetricarboxylic acid.
Dimethylpropylsuccinic acid.
Dimethylprotocatechuic acid.
1 : 4-Dimethylpyrazolone-4-carboxylic acid.
2 : 6-Dimethylpyridine-4 : 5-dicarboxylic acid.
Dimethylsuccinic acid.
Dimethyltetrahydroxypyronedicarboxylic acid.
Dimethyltricarballylic acid.
Dimethyluric acid.
Dimethylvioluric acid.
α-Dinaphthalidocitric acid.
Diphenacetylmalonic acid.
Diphenazone-*o*-hydroxycarboxylic acid.
Diphenoxyanilic acid.
Diphenoxydiethylacetic acid.
Diphenoxydiethylmalonic acid.
Diphenoxyethylmalonic acid.
Diphenoxyhexoic acid.
Diphenylacetylglyceric acid.
Diphenylallophanic acid.
βγ-Diphenylbutyric acid.
Diphenylcarbazidedicarboxylic acid.
Diphenyldiphenylenepropionic acid.
Diphenyleneglycollic acid.
Diphenylfumaric acid.
Diphenylitaconic acid.
Diphenylmaleic acid.
Diphenyloxetonecarboxylic acid.
Diphenylparaconic acid.
Diphenyl*cyclo*pentenonylacetic acid.
3 : 6-Diphenylpyrazine-2 : 4-dicarboxylic acid.
Diphenylsuccinic acid.
Diphenyltetrahydropyronedicarboxylic acid.
Diphenylthiophthaluric acid.
Dipropionylglyceric acid.
Di-iso-propyloxalic acid.
Di-iso-propylsuccinic acid.
d-Disantonous acid.
l-Disantonous acid.
Disantonous acid, inactive.
o-, *p*-, *m*-, Ditoluyltartaric acids.
Divaleryltartaric acid.
Drimyssic acid.
Durenecarboxylic acid.
iso-Durenecarboxylic acid.
Elaidic acid.

Acids. See :—
Ellagic acid.
Ethanetetracarboxylic acid.
Ethanetricarboxylic acid.
Etherthiorufic acid.
Ethoxycinnamic acid.
Ethoxycrotonic acid.
Ethoxyfumaric acid.
Ethoxyglutaconic acid.
Ethoxymaleic acid.
Ethoxyphenylmalonamic acid.
Ethoxyphenyloxamic acid.
β-Ethoxy-β-phenylpropionic acid.
Ethoxyphenylsuccinamic acid.
Ethoxy-β-resorcylic acid.
Ethoxysuccinic acid.
Ethylacetonedicarboxylic acid.
Ethylallylacetic acid.
Ethylanhydrodibenzilacetoacetic acid.
Ethylbenzoylpropionic acid.
Ethyldesmotroposantonous acid.
Ethylenetetracarboxylic acid.
Ethylfumaric acid.
Ethylglycollic acid.
Ethylideneanthranilic acid.
Ethylidenepropionic acid.
Ethylmalonic acid.
Ethylmesitylenesulphonic acid.
d-Ethylsantonous acid.
l-Ethylsantonous acid.
Ethylsantonous acid, racemic.
Ethylsuccinic acid.
p-Ethyltoluenesulphonic acid.
p-Ethyltoluene-*o*-sulphonic acid.
Ethyl-α-thiocarbonic acid.
Eugenolacetic acid.
iso-Eugenolacetic acid.
Fluoresceincarboxylic acid.
Formazylformic acid.
Formazylsulphonic acid.
Formic acid.
Formyladipic acid.
Formylmalonuric acid.
Formylmaluric acid.
Formyloxaluric acid.
Formylphenylacetic acid.
Formylracemuric acid.
Formylsuccinuric acid.
Formylthymotic acid.
Fumaric acid.
Furazanedicarboxylic acid.
Furfurylidenemalonic acid.
β-Galaheptonic acid.
Galaoctonic acid.
Gallic acid.
Gallotannic acid.
Gentisic acid.
Geranic acid.
Glucic acid.
apo-Glucic acid.
Glucoheptonic acid.
Glycocholic acid.

Acids. See :—
- Glycolhydracrylic acid.
- Glycollic acid.
- Glycuronic acid.
- Glyoxylic acid (glyoxalic acid).
- Gorgonic acid.
- Granatic acid.
- Gulonic acid.
- Hæmatic acid.
- Hæmatommenic acid.
- Hæmatommic acid.
- Helianthotannic acid.
- Hemimellitic acid.
- Hemipinamic acid.
- Hendecenoic acid.
- Hendecinoic acid (dehydrohendecenoic acid, undecolic acid).
- Heptane-3 : 3 : 5 : 5-tetracarboxylic acid.
- Heptane-αγγ-tricarboxylic acid.
- Heptinenoic acids.
- Heptoic acid.
- Heptylideneanthranilic acid.
- Hexahydrocinchomeronic acid.
- Hexahydrophenylaminoacetic acid.
- Hexahydroquinolinic acid.
- Hexahydro-*p*-toluic acid.
- Hexahydro-*p*-xylic acid.
- Hexanetricarboxylic acid.
- 3-*cyclo*-Hexanone-1-carboxylic acid.
- *iso*-Hexenoic acid.
- Hexoic acid (caproic acid).
- Hippuric acid.
- Homoaspartic acid.
- Homopiperonylic acid.
- Homopiperonyloxamic acid.
- Homoterpenoylformic acid.
- Homoterpenylic acid.
- Homotropinic acid.
- Hydantoic acid.
- Hydrazinoacetic acid.
- Hydrazinobutyric acid.
- Hydrazino*iso*butyric acid.
- Hydrazinocarboxylic acid.
- Hydrazinopropionic acid.
- Hydrazinovaleric acid.
- Hydrazonephenylglyoxylic acid.
- Hydrocarbostyril-3′-carboxylic acid.
- Hydrocinnamic acid.
- Hydrocyanic acid (under Cyanogen).
- *o*-Hydroxybenzoic acid.
- *m*-Hydroxybenzoic acid.
- *p*-Hydroxybenzoic acid.
- Hydroxycamphanic acid.
- Hydroxycamphoric acid.
- Hydroxycamphoronic acid.
- Hydroxycamphocarboxylic acid.
- Hydroxycamphotricarboxylic acid.
- Hydroxydibromocamphorsulphonic acid.
- Hydroxydimethoxycoumarincarboxylic acid.

Acids. See :—
- β-Hydroxy-α-dimethyl*iso*hexoic acid.
- β-Hydroxy-α-dimethyl-β-*iso*propylpropionic acid.
- αββ-Hydroxydiphenylbutyric acid.
- γ-Hydroxy-βγ-diphenylbutyric acid.
- 2-Hydroxy-2 : 3-diphenyl*cyclo*pentenonylacetic acids.
- Hydroxydisulphonaphthoic acid.
- Hydroxyfumaric acid.
- αγ-Hydroxyglutaric acid.
- 3-Hydroxy*cyclo*hexane-1-carboxylic acid.
- β-Hydroxy*iso*hexoic acid.
- Hydroxylaminesuccinylhydroxamic acid.
- Hydroxylaminoacetic acid.
- Hydroxylauronic acid.
- Hydroxymethanetrisulphonic acid.
- β-Hydroxymethyladipic acid.
- *p*-Hydroxy-*m*-methylbenzoic acid.
- 5 : 1-Hydroxymethyldihydropyridone-3 : 4-dicarboxylic acid.
- Hydroxymethylenephenylacetic acid.
- Hydroxynaphthalenesulphonic acid.
- Hydroxynaphthoic acids.
- Hydroxypentadecoic acid.
- γ-Hydroxy-β-phenoxyethylbutyric acid.
- Hydroxyphenylsuccinamic acid.
- Hydroxypinic acid.
- Hydroxy*iso*propylglutaric acid.
- 4-Hydroxy-1-quinolinesulphonic acid.
- 8-Hydroxytetrahydrocarvonebisnitrosylic acid.
- β-Hydroxytetramethylpropionic acid.
- *exo*-Hydroxy-*o*-toluic acid.
- β-Hydroxy-ααβ-trimethyladipic acid.
- α-Hydroxytrimethylpropionic acid.
- Hygric acid.
- Imidocarbonic acid.
- Indole-2′-carboxylic acids.
- Indoxylglycuronic acid.
- Isanic acid.
- Isophthalic acid.
- Itaconic acid.
- Jalapic acid.
- Jalapinolic acid.
- *iso*-Ketocamphoric acid.
- Ketoketoximebehenic acid.
- Ketopinic acid.
- αγ-Ketopyrhydrindenecarboxylic acid.
- Ketostearic acid.
- Lactic acid, *d*-, *l*-, and *i*.
- Lactylglycollic acid.
- Lactylhydracrylic acid.
- Lanoceric acid.
- Lauranolic acid.
- Lauric acid.
- Lauronic acid.
- Lauronolic acid.

Acids. See :—
Lepidotic acid.
Levulinic acid.
Linoleic acid.
Lithofellic acid.
Lysuric acid.
Lyxonic acid.
Maleic acid.
Malic acid.
l-Malic acid.
Malonic acid.
Mandelic acid.
Mannonic acid.
Melissic acid.
Menthoximic acid.
Mesaconic acid.
Mesitylenecarboxylic acid.
Mesitylenic acid.
Mesitylglyoxylic acid.
Mesityloxidoxalic acids.
Methanedisulphonic acid.
Methanesulphonepropionic acid.
α-*o*-Methoxyacrylic acid.
β-*o*-Methoxyacrylic acid.
m-Methoxybenzoic acid.
o-Methoxybenzoic acid.
Methoxyphenylcrotonic acid.
Methoxyphenylmalonamic acid.
Methoxyphenyloxamic acid.
β-Methoxy-β-phenylpropionic acid, iodo-.
Methoxyphenylsuccinamic acid.
Methylacetoacetic acid.
Methylacetonedicarboxylic acid.
Methyladipic acids.
Methylallylsuccinic acid.
para-Methylallylsuccinic acid.
Methylazimidobenzoic acid.
Methylbenzenedicarboxylic acid.
Methylbenzhydroximic acid.
Methylbenzoylpropionic acid.
Methylbutyloxamic acid.
α-Methylbutyric acid.
Methyl-β-camphoramic acid.
Methylcarbocaprolactonic acid.
para-Methylcarbocaprolactonic acid.
Methylcitraconic acid.
Methyldesmotroposantonous acid.
2-Methyldihydrofurfuran-3 : 4-dicarboxylamic acid.
2-Methyldihydrofurfuran-3 : 4-dicarboxylic acid.
2-Methyldihydrofurfuran-3 : 4 : 5-tricarboxylic acid.
p-Methyldihydroxybenzenesulphonic acid.
5-Methyl-1 : 3-diketo*cyclo*hexane-4 : 6-dicarboxylic acid.
Methyldiphenylitaconic acid.
Methylenecaffeic acid.
Methylenemucic acid.
Methylenesaccharic acid.

Acids. See :—
Methylenetartaric acid.
Methylethylacetic acid.
Methylethylacroleïnanthranilic acid.
Methylethylbenzoylpropionic acid.
3′-Methyl-2′-ethylquinoline-1-carboxylic acid.
Methylethylsuccinic acid.
Methylglutaric acid.
h-Methylhexahydrocinchomeronic acid.
Methyliminophenylpropionic acid.
Methylitaconic acid.
Methylmalonic acid.
Methylmesaconic acid.
Methylnoropiananilidic acid.
Methylnoropianic acid.
Methylnoropian-α-naphthalidic acid.
Methylnoropian-β-naphthalidic acid.
Methylnoropian-*p*-toluidic acid.
3-Methylpentamethylene-1-carboxylic acid.
3-Methylpentamethylene-1 : 1-dicarboxylic acid.
3-Methyl*cyclo*pentanecarboxylic acid.
3-Methyl*cyclo*pentane-1 : 1-dicarboxylic acid.
Methyl*iso*phthalic acid.
β-Methylpicolinic acid.
α-Methylpimelic acid.
n-Methylpipecolinic acid.
Methylpiperidinecarboxyacetic acid.
Methyl*iso*propyladipic acid.
Methyl*iso*propylbutanetricarboxylic acid.
Methyl*iso*propyl*cyclo*butanedicarboxylic acid.
Methyl*iso*propylethanetricarboxylic acid.
Methyl*iso*propylsuccinic acid.
Methyl*iso*propyltetramethylenedicarboxylic acid.
3-Methylpyrazolone*iso*butyric acid.
Methylpyrazolonepropionic acid.
Methylquinolinecarboxylic acid (aniluvitonic acid).
d-Methylsantonous acid.
l-Methylsantonous acid.
Methylsantonous acid, racemic.
Methylterephthalic acid.
Methyltetronic acid.
μ-Methylthiazole-α-carboxylic acid.
β-Methylthio-ψ-uric acid.
Methyluric acid.
Methyl-*iso*-valeric acid.
Mucic acid.
Myristic acid.
Naphthaleneazohydroxynaphthoic acid.
1 : 3′-Naphthylenediamine-4 : 1′-disulphonic acid.

Acids. See :—
1 : 2-Naphthylenediamine-4-sulphonic acid.
1 : 3′-Naphthylenediamine-4-sulphonic acid.
1 : 4′-Naphthylenediamine-2-sulphonic acid.
Naphthalenedicarboxylic acid.
Naphthalenedisulphonic acid.
Naphthalene-3 : 1-disulphonic acid.
Naphthalenesulphonic acid.
α-Naphthalidopyrotartaric acid.
Naphthalidosuccinic acid.
α-Naphthalidopyruvic acid.
β-Naphthalidopyruvic acid.
β-Naphthalidosuccinic acid.
1 : 2 : 3-Naphthaquinonecarboxylic acid.
1 : 2 : 3′-Naphthaquinonecarboxylic acid.
1 : 2-Naphthaquinone-4-sulphonic acid.
α-Naphthoic acid.
β-Naphthoic acid.
Naphtholsulphonic acid.
β-Naphtho-α-methylcinchoninic acid.
α-Naphthoylbenzoic acid.
2 : 1 : 4-Naphthylaminedisulphonic acid.
2 : 1-Naphthylaminesulphonic acid.
α- and β-Naphthylglyoxylic acids.
Naphthylphenylcarbazolecarboxylic acid.
Naphthylsulphamic acid.
Neurostearic acid.
Nipecotinic acid.
Nitramineacetic acid.
iso-Nitraminepropionic acid.
Nonoic acid.
Nopic acid.
Norpic acid.
Nucleïc acid.
Octoic acid.
Octylquinoxalinedodecoic acid.
Œnanthoic acid.
Oleïc acid.
Onmatic acid.
Opiananthranilic acid.
Opianic acid.
Opian-β-naphthylamic acid.
Oxalacetic acid.
Oxalic acid.
Oximamidoxalic acid.
Oximidoacetic-acetic acid.
Oximidopropionic-acetic acid.
Oxymenthylic acid.
Palmitic acid.
Papaverinic acid.
Parabanic acid.
Pelargylaminoazelaic acid.
Pelargylaminobrassylic acid.
Pentamethenylacetic acid.

Acids. See :—
Pentamethenylmalonic acid.
Pentamethylbenzoylpropionic acid.
Pentamethylenetetraminebisdiazobenzenesulphonic acid.
Pentane-$\alpha\gamma\gamma\alpha_1$-tetracarboxylic acid.
Pentanetricarboxylic acid.
Pentenoic acid.
cyclo-Pentylacetic acid.
cyclo-Pentylmalonic acid.
Phenacylsuccinic acid.
Phenacylsulphamidobenzoic acid.
Phenaceturic acid.
iso-Phenethylmandelic acid.
Phenetidylcrotonic acid.
Phenoxazonecarboxylic acid.
Phenoxybenzoic acid.
α-Phenoxybutyric acid.
γ-Phenoxybutyric acid.
γ-Phenoxyethylmalonic acid.
γ-Phenoxyethyl-α-methylacetic acid.
γ-Phenoxyethyl-α-methylmalonic acid.
Phenoxyethyl-*iso*-propylglutaric acid.
Phenoxyethyl-*iso*-propylpropanetricarboxylic acid.
Phenylacetic acid.
ψ-Phenylacetic acid.
Phenylaminocinnamic acid.
Phenyl-β-aminocrotonic acid.
α-Phenylamino-β-phenylpropionic acid.
Phenylazocarboxylic acid.
Phenylbenzoic acids.
1 : 3 : 5-Phenylbenzylpyrazolone-4-carboxylic acid.
Phenylbromacetic acid.
Phenylbromomalonic acid.
Phenylbutyric acid.
Phenylchloracetic acid.
Phenylcinnamic acid.
Phenyldiazosulphonic acids.
Phenyldihydrofurfurantricarboxylic acid.
Phenylenacetic-propionic acid.
Phenylethanetricarboxylic acid.
Phenylformylacetic acid.
Phenylglycollic acid.
β-Phenylhydracrylic acid.
Phenylhydrazinedisulphonic acid.
Phenylhydrazinoformic acid.
β-Phenylhydrazinopropionic acid.
Phenylhydrazonemethanedisulphonic acid.
Phenylhydroxylaminoacetic acid.
Phenylimino-β-butyric acid.
Phenylmalonic acid.
ββ-Phenylmethylhydrazinebenzylmalonic acid.
Phenylmethylhydrazinesulphamic acid.

Acids. See :—
Phenylmethylketotetrahydropyridazinecarboxylic acid.
1 : 3 : 5-Phenylmethylpyrazolone-4-carboxylic acid.
Phenylmethylureidoacetic acid.
Phenylpropionic acid.
Phenyl*iso*propylacetic acid.
1 : 1′-Phenylpropyltetrahydroazindonecarboxylic acid.
bis-Phenylpyrazolonecarboxylic acid.
Phenylselenious acid.
Phenylsemicarbazidecarboxylic acid.
Phenyltartronic acid.
Phenylthiocarbazinic acid.
Phenyl-*p*-toluic acid.
Phenyltoluidoacetic acid.
Phenyl-*p*-tolylketonesulphonic acid.
Phenylureidobenzenesulphonic acid.
Phenylureidocinnamic acid.
Phenylureidophenylpropionic acid.
Phenyl-*m*-xylylketonesulphonic acid, *m*-nitro-.
Phosphorcarnic acid.
Phthalaldehyde-α-naphthylamic acid.
Phthalaldehyde-β-naphthylamic acid.
Phthalaldehyde-*p*-toluidinic acid.
Phthalaldehydic acid.
Phthalanilic acid.
Phthalic acid.
iso-Phthalic acid.
iso-Phthalylhydrazinoacetoacetic acid.
Phyllocyanic acid.
Phyllopurpuric acid.
Pinic acid.
Pinonic acid.
α-Pinonic acid.
Pinononic acid.
Pinoylformic acid.
Pipecolinic acid.
Piperazine-1 : 4-dicarboxylic acid.
β-Piperidobenzylmalonic acid.
Piperylenedicarboxylic acid.
Polystichic acid.
Prehnitylic acid.
Propanehexacarboxylic acid.
Propanetetracarboxylic acid.
Propanetricarboxylic acid.
Propargylpentacarboxylic acid.
Propiolic acid.
Propionic acid.
Propionylglycollic acid.
Propionylmalic acid.
Propionylmandelic acid.
iso-Propylacetic acid.
Propylallylacetic acid.
iso-Propylallylmalonic acid.
iso-Propylbenzoylpropionic acid.
d-*iso*-Propyl-β-*iso*butylacrylic acid.
α-*iso*-Propylcarboxyglutaric acid.
iso-Propylethanetricarboxylic acid.

Acids. See :—
iso-Propylglutaric acid.
iso-Propylglutolactonic acid.
iso-Propylheptanonoic acid.
Propylideneacetic acid.
Propylideneanthranilic acid.
Propylmalonic acid.
iso-Propylmalonic acid.
Propylmesitylenesulphonic acid.
iso-Propylmethylbenzoylpropionic acid.
α-*iso*-Propylpropane-$\alpha\alpha\alpha^1$-tricarboxylic acid.
iso-Propylsuccinic acid.
Protesic acid.
Proteic acid.
Protocatechuic acid.
Psoromic acid.
Pulegenic acid.
Pulegonedinitrosylic acid.
5-Pyrazolone-3-carboxylic acid.
Pyridine-3-sulphonic acid.
Pyrocinchonic acid.
Pyrolevulinic acid.
Pyruvic acid.
Quininic acid.
2′-Quinolylacetic acid.
2′-Quinolylacrylic acid.
2′-Quinolylglyceric acid.
2′-Quinolylpropionic acid.
Quinonedimalonic acid.
Racemic acid.
Rapic acid.
Rhamnohexonic acid.
Rhamnonic acid.
iso-Rhamnonic acid.
Rhodinic acid.
Ricininic acid.
Saccharic acid.
Saccharinic acid.
Salicylic acid.
Sandaracolic acid.
Santalenic acid.
Santonic acid.
meta-Santonic acid.
l-Santonous acid.
d-Santonous acid.
l-Santonous acid.
Santonous acid, racemic.
iso-Santonous acid.
Scamminolic acid.
Scammonic acid.
Sebacic acid.
Selenodiacetic acid.
Sodiodesmotroposantonous acid.
l-Sodiosantonous acid.
Sorbic acid.
Stearic acid.
Stearolic acid.
Stearoxylic acid.
Stereocaulic acid.

Acids. See :—
  Stilbenedisulphonic acid.
  Suberic acid.
  Succinamic acid.
  Succinic acid.
  Succinuric acid.
  Succinylhydroxamic acid.
  m-Sulphamidobenzoic acid.
  iso-p-Sulphamidobenzoic acid.
  Sulphaminebenzoic acid.
  p-Sulphanilic acid.
  Sulphanilidobenzoic acid.
  Sulphobenzoic acid.
  m-Sulphochlorobenzoic acid.
  Sulphohydrazimethylenecarboxylic acid.
  Sulphohydrazimethylenedisulphonic acid.
  Sulphonaphthalenedicarboxylic acid.
  Sulphonaphthylphosphinic acid.
  αβ-Sulphonedipropionic acid.
  β-Sulphonedipropionic acid.
  o-Sulpho-*p*-toluic acid.
  Tannic acid.
  Tariric acid.
  Tartaric acid.
  meso-Tartaric acid.
  Taurocholic acid.
  Terebic acid.
  Terephthalic acid.
  Terephthalylazoimic acid.
  Terephthalylhydrazidacetoacetic acid.
  Terephthalylhydrazinic acid.
  Terpenylic acid.
  Tetracetylsuccinylhydroxamic acid.
  Tetrahydrocarvonebisnitrosylic acid.
  Tetrahydrocumic acid.
  Tetrahydronaphthalene-1 : 4′-dicarboxylic acid.
  Tetrahydro-*β*-naphthyloxamic acid.
  Tetrahydrophthalic acid.
  Tetrahydroxydecoic acid.
  2 : 4 : 2′ : 4′-Tetrahydroxydiphenylacetic acid.
  Tetrahydro-*p*-xylic acid.
  Tetramethylacetonedicarboxylic acid.
  Tetramethylbenzoic acids.
  Tetramethylbenzoylpropionic acid.
  Tetramethylene-1 : 3-dioxalylic acid.
  Tetramethylsuccinic acid.
  Tetrolic acid.
  Tetronic acid.
  β-Thiophencarboxylic acid.
  Thiorufic acid.
  Thymic acid.
  Thymotic acid.
  p-Toluenediazoamidobenzenesulphonic acid.
  p-Toluenesulphinic acid.
  o-, *m*-, and *p*-Toluic acids.
  Toluidosulphobenzoic acid.
  o-, *p*-, and *m*-Toluric acids.

Acids. See :—
  ψ-Tolylacetic acid.
  p-Tolylglyoxylic acid.
  Tolylsulphamic acid.
  Triazoacetic acid.
  1 : 2 : 3-Triazoledicarboxylic acid.
  Tricarballylic acid.
  Trimethoxycoumarincarboxylic acid.
  Trimellithic acid.
  Trimethylacrylic acid.
  Trimethylapionolic acid.
  Trimethylbenzoic acids.
  Trimethylbenzoylpropionic acid.
  Trimethylcyanuric acid.
  Trimethylglutaric acid.
  2 : 4 : 6-Trimethylmandelic acid.
  2 : 2 : 4-Trimethylpentan-3-oloic acid.
  Trimethylpimelic acid.
  Trimethylpropionic acid.
  Trimethylpyruvic acid.
  Tropic acid.
  Tropinic acids.
  Turpethic acid.
  Undecolic acid (hendecinoic acid).
  Undecylenic acid (hendecoic acid).
  Undecylinenoic acid (hendecenoic acid).
  Uramidobenzoic acids.
  Uramidodibenzoic acids.
  Urethaneacetic acid.
  Uric acid.
  ψ-Uric acid, *β*-thio-.
  Usnic acid.
  Valeric acids.
  iso - Valerophenone - *o* - carboxylic acid.
  Valeroylmandelic acid.
  Vanillic acid.
  Vanillinacetic acid.
  Veratroylcarboxylic acid.
  Veratroylglyoxylic acid.
  Vinylpyridinecarboxylic acid.
  Xylenesulphonic acid.
  p-Xylic acid.
  Xylonic acid.
  Xylosotrihydroxyglutaric acid.
  m-Xylylcarboxylic acid.
  Xylylene-*exo*-diphthalamic acid.
  m-Xylylglyoxylic acid.

Acmite from Greenland (Ussing), A., ii, 372.

Acokanthera schimperi, glucoside from (Fraser and Tillie), A., i, 386.

Aconine, acetyl and benzoyl derivatives of (Dunstan and Carr), P., **1895**, 178.

ψ-Aconine (Freund and Niederhofheim), A., i, 451.

Aconitic acid, occurrence of, in *Aconitum heterophyllum* (Jowett), T., 1521; P., **1896**, 158.

Aconitic acid, preparation from *Adonis vernalis* (Orloff), A., i, 136.
Aconitine, formula of (Freund), A., i, 192.
  action of methylic alcohol on (Dunstan, Tickle, and Jackson), P., **1896**, 159.
  estimation of (Umney), A., ii, 283.
  estimation of nitrogen in, by the absolute method (Dunstan and Carr), P., **1896**, 48.
ψ-Aconitine and its salts and hydrolysis (Freund and Niederhofheim), A., i, 451.
Aconitum heterophyllum, atisine, the alkaloid of, and aconitic acid in (Jowett), T., 1518; P., **1896**, 158.
Acraldehyde, preparation of (Hofmann Lecture), T., 697.
Acridine, formation of (Pictet and Hubert), A., i, 503.
  behaviour in sunlight (Orndorff and Cameron), A., i, 176.
Acrylhydrazone, conversion into pyrazoline (Curtius), A., i, 339.
Acrylic acid, preparation of (Hofmann Lecture), T., 697.
  action of hydrazine on (Curtius), A., i, 339.
Actinolite from Ontario (Hoffmann), A., ii, 257.
Address, congratulatory, to the Institute of France, P., **1895**, 167; reply thereto, P., **1895**, 199.
    to Lord Kelvin, P., **1896**, 121.
    to Professor Stannizzaro, P., **1896**, 120.
  of condolence on the death of Louis Pasteur, P., **1895**, 197.
  presidential, of A. W. Vernon Harcourt, T., 563; P., 80.
Adenine, isolation of, from tea extract (Krüger), A., i, 450.
  compound of, with theobromine in tea (Krüger), A, i, 450.
Adipic acid from methyltropinic acid (Willstätter), A., i, 267.
  crystallography of (Ciamician and Silber), A., i, 397.
Adipinketone, condensation of, with benzaldehyde (Vorländer and Hobohm), A., i, 603.
Adonitol, compound of, with acetone (Speier), A., i, 77.
Ægyrite, artificial (Bäckström), A., ii, 115.
Æschynite from Norway (Erdmann), A., ii, 570.
Afzelia Cuanzensis, the yellow dye of (Kristelli), A., ii, 208.
Affinity constant. See Electrolytic conductivity.
Agaricaceæ, amount of tannin in (Naumann), A., ii, 538.
Agaricus muscarius, amanitin, the red pigment of (Griffiths), A., i, 653.
Air. See Atmospheric air.
Air-bladder of fishes, presence of argon in (Schloesing and Richard), A., ii, 436.
Air-pump, automatic mercury (Krafft and Dyes), A., ii, 89.
  modification of von Babo's water-mercury (Precht), A., ii, 415.
  new form of mercury (Wood), A., ii, 516.
Ajuga reptans, dyes of (Weigert), A., i, 388.
α-Alanine (*α-aminopropionic acid*, action of sodium hypochlorite on (de Coninck), A, i, 282.
Albite from Burma (Bauer), A., ii, 311.
  from Crete (Viola), A., ii, 433.
  from France (Fouqué), A., ii, 532.
  from Maryland (Hillebrand), A., ii, 40.
  from Russia (Glinka), A., ii, 567.
Albumin, presence of an, in diastase (Osborne), A., i, 399.
  decomposition products of (Hedin), A., i, 659.
  conversion of, into peptones (Schrötter), A., i, 112.
  relation of, to peptones and albumoses (Schrötter), A., i, 515.
  influence of, on initial rate of osmosis (Lazarus-Barlow), A., ii, 196.
  absorption of, in the small intestine (Friedländer), A., ii, 536.
  detection of, in urine (Jolles), A., ii, 344.
  estimation of, in milk (van Slyke), A., ii, 132.
  estimation of, in beer wort (Schjerning), A., ii, 631.
Albumin, active, connection of proteosomes with (Loew), A., ii, 59.
Albumin, egg-, demonstration of presence of amido-groups in (Curtius), A., i, 337.
  reaction of and constitution of (Schiff), A., i, 632.
  new proteïd from (Blum), A., i, 659.
Albumin, serum-, presence of, in normal urine (Mörner), A., ii, 120.
  as a nutrient for the frog's heart (White), A., ii, 437.
Albumin, vegetable-, constitution of (Fleurent), A., i, 112.
  decomposition of, in *Lupinus luteus* (Ziegenbein), A., ii, 265.
  occurrence of, in plants in spring and autumn (Daikuhara), A., ii, 55.

- Albuminates, estimation of, in cheese (STUTZER), A., ii, 684.
- Albumose, presence of, in urine during fever (KREHL and MATTHES), A., ii, 667.
  - estimation of, in cheese (STUTZER), A., ii, 684.
- Albumoses, acetyl derivatives of (SCHRÖTTER), A., i, 515.
  - absorption of, from the small intestine (FRIEDLÄNDER), A., ii, 536.
  - precipitation of, by zinc sulphate (BÖMER), A., ii, 83.
  - tests for (SCHRÖTTER), A., i, 112.
- Alcaptonuria, presence of homogentisic acid in (LIKHATSCHEFF), A., ii, 492.
- Alcohol. See Ethylic alcohol.
- Alcohol, $C_9H_{16}O$, from reduction of camphorone (KERP), A., i, 448.
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  - *n*-Acetobutylic alcohol.
  - Amylic alcohol.
  - *iso*-Amylic alcohol.
  - Anilinomethylbutylcarbinol.
  - Anisic alcohol.
  - Benzhydrol.
  - Benzylic alcohol.
  - Bidiphenylene-ethyleneglycol.
  - Borneol.
  - *iso*-Butylallylcarbinol.
  - *iso*-Butylic alcohol.
  - Cardol.
  - Catechol.
  - Cholesterol.
  - Cinnamic alcohol.
  - Citronellol.
  - Crotonylic alcohol.
  - Cuminic alcohol.
  - Diallylethylic alcohol.
  - Diallyl*iso*propylic alcohol.
  - Dihydroxybutane, tertiary.
  - Dimethylethylcarbinol.
  - 2 : 5-Dimethylhexan-3-olone-4.
  - Dimethylpropylcarbinol.
  - Dimethyl*iso*propylcarbinol.
  - Diphenyltetramethyleneglycol.
  - Dipropylisopropylic alcohol.
  - Erythritol.
  - Ethylic alcohol.
  - Geraniol (lemonol).
  - Glycerol.
  - Hexylallylcarbinol.
  - Homalinalol.
  - Hydrobenzoïn.
  - *iso*-Hydrobenzoïn.
  - Ketone alcohol, $C_{10}H_{18}O_2$, from menthene.
  - Koprosterol.
  - Lanolinic alcohol.
  - Licareol.
  - Licarhodol.
  - Linalol.
  - $\Delta^{8(9)}$-Menthene-1 : 2-diol.
  - Mentheneglycol.
  - Methylallylhexenylcarbinol.
  - Methyl-*iso*-butylcarbinol.
  - Methylic alcohol.
  - Methylsalicylic alcohol.
  - β-Methyltetramethyleneglycol.
  - Nonylic alcohol.
  - Octylic alcohol.
  - Pentaglycol.
  - Phenylhydroxybenzylcarbinol.
  - Pinacone.
  - Pinacone, $C_{18}H_{34}O_2$, from reduction of *iso*-pharone.
  - Pinacone, $C_{18}H_{30}O_2$, from reduction of camphorone.

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  Pinolglycol.
  Phloroglucinol.
  Propylic alcohols.
  Pulegol.
  Quercitol.
  2′-Quinolylpropylic alcohol.
  Rhodinol.
  Sobreritritol.
  Sobrerol.
  Tetrahydrocarveol.
  Trihydroxymenthane.
  Trimethylenic glycol.
  2 : 2 : 4-Trimethylpentane-1 : 3-diol.
  Triphenylcarbinol.
  Triphenylvinyl alcohol.
  Vinyl*cyclo*propaneglycol.
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  Apiolaldehyde.
  Anisaldehyde.
  Benzaldehyde.
  Benzyloxybenzaldehyde.
  Benzoylvanillin.
  iso-Butylaldehyde.
  Cinnamaldehyde.
  Citronellaldehyde.
  Crotonaldehyde.
  Cuminaldehyde.
  $\Delta^{4,6}$-Dihydrobenzaldehyde.
  2 : 4-Dimethoxybenzaldehyde.
  Dimethylbenzaldehyde.
  Dimethylgentisaldehyde.
  Formaldehyde.
  para-Formaldehyde.
Aldehydes. See :—
  Formylphenylacetic acid.
  Furfuraldehyde.
  Geranaldehyde.
  Hydroxy-δ-methylfurfuraldehyde.
  Licarhodaldehyde.
  Methylethylacetaldehyde.
  δ-Methylfurfuraldehyde.
  Methylpropylbenzaldehyde.
  Methylsalicylaldehyde.
  Norpic acid aldehyde.
  Protocatechuic aldehyde.
  Rhodinaldehyde.
  Salicylaldehyde.
  Santalal.
  Trianisaldehyde.
  Tribenzaldehyde.
  Tribenzoylvanillin.
  Tribenzyloxybenzaldehyde.
  Tricumaldehyde.
  Tridimethylgentistic aldehyde.
  Trigentistic aldehyde.
  Trimethylbenzaldehyde.
  2 : 2 : 4-Trimethylpentan-3-olal-1.
  Trimethylvanillin.
  Tripiperonal.
  Tritolualdehyde.
  Trivanillin.
  iso-Valeraldehyde.
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  ψ-Aconitine.
  Adenine.
  Anagyrine.
  Anhalonine.
  Anhalonidine.
  Apopilocarpine.
  Aristolochine.
  Asparagine.
  Atisine.
  Atropine.
  Atroscine.
  Baptitoxine.
  Bebirine.
  Benzoylpellotine.
  Berbamine.
  Berberine.
  Brucine.
  Caffeine.
  Canadine.
  Cephaeline.
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  Chelerythrine.
  Chelilysine.
  Cinchona alkaloids.
  Cinchonidine.
  α-Cocäthyline.
  Cocaine.
  α-Cocaine.
  Conhydrine.
  Coniine.
  Conyrine.
  Creatinine.
  Cuskhygrine.
  Cusparine.
  Cytisine.
  Deoxycinchonidine.
  Deoxycinchonine.
  Deoxyconchinine.
  Deoxyquinine.
  Dihydrogranatone.
  α-Ecgonine.
  Emetine.
  Eserine (physostigmine).
  Gelseminine.
  Granatanine.
  Granatenine.
  Granatoline.
  Granatonine.
  Harmaline.
  Harmine.
  Homocinchonidine.
  Hydrastinine.
  Hydrocotarnine.
  Hyoscine.
  Lophophorine.
  Matrine.
  Meroquinenine.
  Mezcaline.
  Methylscopoline.
  Morphine.
  Narcotine.
  iso-Narcotine.
  Nicotine.
  Norsparteïne.
  Oxyacanthine.
  Oxygranatine.
  Papaverine.
  Paucine.
  Pellotine.
  Picro-ψ-aconitine.
  Pilocarpine.
  Piperidine.
  Piperine.
  Quinine.
  Scopolamine.
  Scopoligenine.
  Scopoline.
  Sparteine.
  Strychnine.
  Tetrahydrocinchonidine.
  Tetrahydroquinidine.

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  Tetrahydroquinine.
  Theobromine.
  Tropeines.
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  ψ-Tropine.
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  β-Acetamido-μ-methylthiazole-α-carboxylamide.
  Acetamidophenol, 2 : 4-bromonitro-.
  Acetamidothymol.
  Acetanilide.
  o-Acetanisoilamide, *p*-nitro-.
  Acetethylanilamide.
  Acetobenzamide.
  Acetobenzanilide.
  Acetodiphenylamide.
  Acetoguaiacolamide, nitro-.
  Acetomethylcarbamide.
  Acetonylcarbamide.
  Aceto-xylidide.
  Acetyllactylacetamide.
  Amidoformic acid, methylamides of.
  Amygdalylamidophenetoil.
  n-Allylbutylene-ψ-thiocarbamide.
  Allylthiocarbamide.
  Allylthiourea.
  Anthrapurpuramide.
  Asparagine.
  Aspartamide.
  Azimidouramidobenzoic acid.
  Azodiisobutyramide.
  Benzamide.
  Benzamidoacetamidothymol.
  Benzamidobenzoylthymol.
  p-Benzamidosulphonamide.
  Benzamidothymol.
  Benzanilide.
  Benzenesulphonamide.
  Benzene-*o*-sulphonamide, *p*-bromocyano-.
  Benzenesulphonanilide.
  Benzenesulphonphenylhydroxylamide.
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  Benzenesulphonylhydroxylamide.
  Benzenesulphotoluidide.
  Benzenylamidoxime.
  Benzethylamide.
  Benzethyleneamide.
  Benzobutylamide.
  Benzochloro-xyleneamides.
  Benzodichloranilide.
  Benzodiethylthiourea.
  Benzoformanilide.
  Benzoform-*o*-toluidide.
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  Benzomethylamide.
  Benzo-*m*-toluamide.
  Benzoveratrylamide.
  Benzo-*m*-xylylenediamide.
  Benzoylbenzamide, *m*-nitro-.
  Benzylidenedicarbamide.
  Benzyl-*o*-sulphamidobenzoic acid.
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  ab-iso-Butyro-α-naphthylthiocarbamide.
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  ab-iso-Butyrotolylthiocarbamides.
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  Camphenesulphonamides, chloro-.
  Camphoramic acid.
  Camphoronimamide.
  Carbamide.
  Carbonyldicarbamide.
  Cinchomeramide.
  Crotonamide.
  iso-Crotonamide.
  Cymenensulphonamide.
  Diacetamidothymol.
  Diacetodimethylanilinediamide.
  m-Diacetophenylenediamide.
  Diacetyldilactamide.
  Diallylacetamide.
  Dibenzamide.
  iso-Dibenzamido-*p*-xylidene.
  Diethoxyphenylmalonamide.
  Diethoxyphenyloxamide.
  Diethylcyanacetamide.
  Dihippenylcarbamide.
  Dihydro-*cis*-campholytamide.
  Dihydrohippuroflavin.
  Dihydroxyphenylmalonamide.
  Dihydroxyphenyloxamide.
  Dimethoxyphenylmalonamide.
  Dimethoxyphenyloxamide.
  Dimethylcyanacetamide.
  Dimethylmalonamide.
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  Dipropylcyanacetamide.
  Ditolylcarbamides.
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- Ethylbenzamide.
- Ethyl-*iso*-formanilide.
- Ethyloxamide.
- Ethylsulphonic acid, methylamides of.
- *p*-Ethyltoluenesulphonamide.
- Formamide.
- Formanilide.
- Formobenzanilide.
- Formobenzo-*p*-toluidide.
- Formocarbamide.
- Hemipinamic acid.
- Heptoic acid, methylamides of.
- Hexahydro-*p*-xylanilamide.
- Hydrazodicarbonamide.
- Hydrazodicarbothioallylamide.
- 3-Hydroxy*cyclo*hexane-1-carboxylamide.
- Hydroxymethyldihydropyridonedicarboxylamide.
- Mandelamide.
- Malonamide.
- Methylamidoformamide.
- Methylbenzamide.
- Methylbenzylbenzamide.
- Methyl-*iso*-butylcarbamide.
- Methyl-β-camphoramide.
- Methyldihydrofurfurandicarboxylamic acid, ethylic salt of.
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- μ-Methylimidazolylphenylthiourea.
- μ-Methylimidazolyl-*o*-tolylthiourea.
- Methylpropylcarbamide.
- μ-Methylthiazole-α-carboxylamide.
- 1-Naphthalenesulphonamide.
- α-Naphthoylbenzamide.
- α-Naphthyl-*o*-acetamidobenzylacetamide.
- β-Naphthylazocarboxylamide.
- β-Naphthylopianamide.
- Oxamide.
- *n*-Palmito-*ν*-phenylbenzylthiourea.
- *a*-Palmito-*b*-phenylbenzylurea.
- *n*-Palmito-*ν*-phenylmethylthiourea.
- αβ-Palmitophenylthiocarbamide.
- Palmitothiocarbamide.
- *ab*-Palmitotolylthiocarbamides.
- α-Phenoxybutyramide.
- α-Phenoxybutyrothiamide.
- Phenylacetamide.
- ψ-Phenylacetamide.
- *n*-Phenylaceto-*ν*-phenylbenzylthiourea.
- Phenylacetophenylthiocarbamide.
- *ab*-Phenylaceto-*o*-tolylthiocarbamide.
- *ab*-Phenylaceto-*p*-tolylthiocarbamide.
- Phenylallylthiocarbamide.
- Phenylazocarboxylamide.
- Phenylbenzylhydroxyethylamine.
- *n*-Phenylbutylene-ψ-thiocarbamide.

Amides. See :—
- *p*-Phenylenecarbamide.
- Phenyl*iso*crotyl (?)-thiocarbamide.
- *s*-Phenyl-γ-ethoxybutylthiocarbamide.
- Phenylglycollamide.
- Phenylhydrazidoacetamide.
- Phenylmethyl*iso*amylcarbamide.
- Phenylmethyl*iso*amylthiocarbamide.
- Phenylmethyl*iso*butylcarbamide.
- Phenylmethyl*iso*butylthiocarbamide.
- Phenylmethylpropylcarbamide.
- Phenylmethylpropylthiocarbamide.
- Phenylsulphonic acid, methylamides of.
- Picric acid, methylamides of.
- Pinacolylthiocarbamide.
- Piperazine-1 : 4-dicarboxylamide.
- Propionamide.
- *n*-Propiono-*ν*-phenylbenzylthiourea.
- *n*-Propiono-*ν*-phenylmethylthiourea.
- *ab*-Propionophenylthiocarbamide.
- *ab*-Propionotolylthiocarbamides.
- Propylene-ψ-thiocarbamide.
- Pulegenamide.
- Pyrotartaric acid, amide of.
- Quininamide.
- 2′-Quinolylacrylamide.
- 2′-Quinolylpropionamide.
- Salicylamide.
- Stearamide.
- *ab*-Stearo-α-naphthylthiocarbamide.
- Stearo-α-naphthylurea.
- *n*-Stearo-*ν*-phenylbenzylthiourea.
- *a*-Stearo-*b*-phenylbenzylurea.
- *ab*-Stearo-*o*-tolylthiocarbamide.
- Stearo-*o*-tolylurea.
- *ab*-Stearo-*m*-xylylthiocarbamide.
- *ab*-Stearo-*m*-xylylurea.
- Succinamide.
- Succinic acid, methylamides of.
- Succinic anhydride, *o*-carboxyphenylamide of.
- Succinic anhydride, β-naphthylamide of.
- Sulphamidobenzamide.
- Sulphuric acid, methylamides of.
- Tartronamide.
- Tetramethyloxamide.
- Tetramethylsuccinamide.
- Uramidodibenzoic acids.
- Toluenesulphonamide.
- Tribenzenesulphonhydroxylamide.
- Trimethylacetic acid, methylamide of.
- Trimethylallylthiocarbamide.
- Tritoluenesulphonamide.
- Valeranilide.
- Xylenesulphonamide, chloro-.

Amidines, discovery of (HOFMANN LECTURE), T., 704.

Amido. See Amino.

Amine $C_8H_{15}\cdot NH_2$, from dihydro-*cis*-campholytamide (Noyes), A., i, 696.
  $C_9H_{11}Br_2NO$, obtained by action of ammonia on dibromo-ψ-cumenol bromide (Auwers and Hof), A., i, 422.
  $C_{10}H_{17}\cdot NH_2$, from reduction of oxime of ketone $C_{10}H_{16}O$; its hydrochloride and carbamide (Wallach), A., i, 102.
  $C_{14}H_{14}Br_2N_2O_2$, obtained in the preparation of *p*-brom-*o*-anisidine (Meldola, Woolcott, and Wray), T., 1329.
  $C_{14}H_{23}NH_2$, from oxime of ketone $C_{14}H_{22}O$; its hydrochloride, platinochloride, nitrate (Wallach), A., i, 572.
  $C_{18}H_{23}Br_2NO_2$, derived from the dimethylaniline derivative of dibromo-ψ-cumenol bromide (Auwers and Senter), A., i, 424.
  $C_{36}H_{27}N_5$, obtained in the oxidation of phenyl-*o*-phenylenediamine (O. Fischer and Dischinger), A., i, 539.

Amines, $C_{22}H_{20}N_2O$, isomeric, formed by action of alcoholic potassium cyanide on benzylidene-*p*-toluidine (Miller and Plöchl), A., i, 609.

Amines, action of bromine on (Hofmann Lecture), T., 720.
  action of carbon bisulphide on (Hofmann Lecture), T., 663.
  separation of (Hofmann Lecture), T., 662.

Amines, aromatic, action of phosphorous oxychloride on (Michaelis and Silberstein), A., i, 344.

Amines, fatty, action of arsenious chloride on (Michaelis and Luxembourg), A., i., 343.
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  Allyltoluidine.

Amines. See:—
  Amylamine.
  iso-Amylamine.
  Anilaminobenzenylphenylimidine.
  Aniline.
  o-Anisidine.
  p-Anisidine.
  Arabinosamine.
  Azotrinaphthyldiamine.
  Benzene-4-azo-2-aminophenol, *m*-nitro-.
  Benzenesulphonobenzylhydroxylamine.
  Benzidine.
  Benzophenylethylenediamine.
  Benzophenylpropylenediamine.
  Benzylamine.
  Benzylaminophenetoil.
  Benzylaniline.
  Benzylbromethylamine.
  Benzyldibromodiethylamine.
  Benzyldihydroxydiethylamine.
  Benzyldimethylamine.
  Benzylhydroxyethylamine.
  Benzylideneaminophenylimido-β-butyric acid.
  Benzylideneaminothymol.
  Benzylideneaniline.
  Benzylidene-1 : 2-naphthylenediamine.
  Benzylidene-*o*-phenylenediamine.
  Benzylphenylhydroxyethylamine.
  Benzylvinylamine.
  Bishydroxytetrahydronaphthylamine.
  Butylamine.
  iso-Butylamine.
  Catechol, 5-nitro-3-amino-.
  α-Crotylamine.
  iso-Crotylamine.
  ψ-Cumenol bromide, dibromo-, methylamine, ethylamine, diethylamine, β-naphthylamine, methylaniline, diethylaniline, derivatives of.
  Cumylidene-*p*-aminothymol.
  Decylamine.
  Decylenediamine.
  Dehydrothiotoluidine.
  Diallylethylamine.
  Diamylamine.
  Dibenzylamine.
  Dibenzylidenediaminopentamethylenetetramine.
  Dibenzylidene-*o*-phenylenediamine.
  Di-*iso*-butylamine.
  Dicinnamylidenediaminopentamethylenetetramine.
  Diethylamine.
  Diethylaminohexahydrotoluic acid.
  2 : 3-Diethylaminohydroxytetrahydronaphthalene.
  Diethylaminophenonaphthoxazime.
  Diethylaminophenonaphthoxazone.

Amines. See :—
m-Diethylaminophenylic salts.
exo-Diethylamino-*o*-toluic acid.
Diethylaniline.
Diethylenetriamine.
Diethyldiethylenediamine.
Diethylethylenediamine.
Di-*o*-hydroxybenzylidenediaminopentamethylenetetramine.
Dimethylamine.
Dimethylaminobenzenyldimethylimidine.
Dimethylaminobenzenyl-β-naphthylimidine.
Dimethylaminodiphenazone.
2 : 3-Dimethylaminohydroxytetrahydronaphthalene.
Dimethylaminophenonaphthoxazime.
Dimethylaminophenonaphthoxazone.
Dimethylaminophenylic salts.
Dimethylaniline.
Dimethylnaphthylamines.
Dimethylnitramine.
Dimethyl-*p*-phenylenediamine.
Dimethyltoluidines.
Dimethyl-3 : 4-tolylenediamine.
Di-β-naphthylamine.
Di-*m*-nitrobenzylidenediaminopentamethylenetetramine.
Diphenylamine.
Diphenyldiethylenediamine.
Diphenyldisulphonedimethyl-*p*-phenylenediamine.
2 : 5-Diphenyldisulphone-*p*-phenylenediamine.
Diphenylethylenediamine.
Diphenylformamidine.
Diphenylsulphone-*o*-aminophenol.
Dipropylamine.
γ-Ethoxybutylamine.
p-Ethoxyphenyl-5-chloro-*m*-tolylamine.
p-Ethoxyphenyl-*m*-ethoxy-*p*-phenylenediamine.
p-Ethoxyphenyl-*o*-tolylamine.
p-Ethoxyphenyltolylenediamines.
Ethoxytolylphenylenediamines.
Ethoxytolyltolylenediamines.
Ethylamine.
Ethylaniline.
Galactoseamine.
Guanidine.
cyclo-Heptenamine.
Heptylamine.
Hexadecylamine.
Hexamethylenediamine.
Hexamethylenetetramine.
β-*iso*-Hexylamine.
Hippuro-*p*-toluylenediamine.
Hydroxydiphenylethylamine.
Hydroxy-β-*iso*-hexylamine.
Hydroxyethoxymethylquinoline.

Amines. See :—
Hydroxynaphthylhydroxyphenylamine.
Hydroxyphenylamine.
2 : 3-Hydroxytetrahydronaphthylamine.
Maltose-amine.
Menthylamine.
Mesidine.
Methylamine.
Methyl-*iso*-amylamine.
Methylaniline.
Methylbenzylamine.
Methylbutylamine.
Methyl-*iso*-butylamine.
Methylbutylnitramine.
Methyldiethenyltetraminobenzene.
Methyldiethylamine.
Methyldiphenylamine.
β-Methylhydroxylamine.
Methylnitramine.
Methylnoropiananilidic acid.
Methylnoropianic acid tetrahydroquinoline.
Methylnoropian-α-naphthalidic acid.
Methylnoropian-β-naphthalidic acid.
Methylnoropian-*p*-toluidic acid.
Methylphenylaminobenzenylmethylimidine.
Methylpropylamine.
Methylpropylaniline.
β-Methyltetramethylenediamine.
Methyl-*p*-toluidine.
αβ-Naphthobenzaldehydine.
α-Naphthylamine.
β-Naphthylamine.
2 : 1-Naphthylaminesulphonic acid.
β-Naphthylaminobenzenylmethylimidine.
α-Naphthyl-*o*-aminobenzylamine.
β-Naphthyl-*o*-aminobenzylamine.
α-Naphthyldipropylamine.
Naphthylenediamine.
1 : 3-Naphthylenediamine.
β-Naphthylmethylaminobenzenylmethylimidine.
Bis-*p*-nitrodiazobenzenepentamethylenetetramine.
Nonylamine (Ennylamine).
Opiananthranilic acid.
Opianic acid, β-naphthylamine.
Phenetidine.
Phenol, 2 : 4 : 6-bromonitramino-.
Phenylaminobenzenylanilimidine.
Phenylaminobenzenylmethylimidine.
Phenylchloramine.
Phenyldimethylamine.
Phenylenediamines.
Phenylene-ethylenediamine.
Phenyl-6-ethoxy-1 : 3 : 4-tolylenediamine.
Phenylethylenediamine.

Amines. See :—
Phenylglyoxylethoxybenzylamine.
Phenylglyoxylmethoxybenzylamine.
β-Phenylhydroxylamine.
Phenylic ether, diamino-.
Phenylmethylpropylamine.
Phenyl-*o*-phenylenediamine.
Phenyltolylamine.
Phthalaldehydemethylaniline.
Phthalaldehyde-α-naphthylamic acid.
Phthalaldehyde-β-naphthylamic acid.
Phthalaldehyde-*p*-toluidinic acid.
Phthalaldehydic-α-naphthylamine.
Phthalaldehydic-β-naphthylamine.
Phthalaldehydicpiperidine.
Phthalaldehydictetrahydro-*iso*-quinoline.
Phthalaldehydic-*p*-toluidine.
Piperonylaminoacetone.
Piperonylbenzylamine.
Propylamine.
Pulegoneamine.
Sorbose-amine.
Succinylacetoxylamine.
Tetrethylaminodiphenoxazimium chloride and iodide.
Tetraethyldiamino-α-azonaphthalene.
Tetrahydrocarvylamine.
Tetrahydro-α-naphthylamine.
Tetrahydro-β-naphthylamine.
Tetramethylaminodiphenoxazimium chloride and iodide.
Tetramethyldiamino-α-azonaphthalene.
Tolidine.
Toluidines.
Tolylethoxy-*o*-phenylenediamines.
o-Tolyl-6-ethoxy-1 : 3 : 4-tolylenediamine.
m-Tolyl-6-ethoxy-1 : 3 : 4-tolylenediamine.
p-Tolyl-6-ethoxy-1 : 3 : 4-tolylenediamine.
Tolylmethylnitramine.
Triethylchrysaniline.
Triethyldiethylenetriamine.
Triethylenetriamine.
Triethyltriethylenetriamine.
Trimethylamine.
Trimethylchrysaniline.
Trimethylenephenylenediamine.
Tripropylamine.
iso-Undecylamine (*iso*-Hendecylamine).
Veratrylamine.
Vinylamine.
1 : 3 : 4-Xylidine.
m-Xylylene-2 : 5-diamine.
Xylose-amine.
Amines. See also Bases.
Amino-acid, $C_{10}H_{19}NO_2$, from cyanolauronic acid, and its platinochloride (Hoogewerff and van Dorp), A., i, 314.
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Amino-derivatives. See also :—
Acetic acid (under Glycocine).
Acetylphenimeisatin.
Azobenzene.
Azonaphthalene.
Azoxybenzene.
Benzaldehyde.
Benzaldehydephenylhydrazone.
Benzaldehydine.
Benzaldoxime.
Benzanilide.
Benzenesulphonic acid.
Benzenylamidoxime.
Benzenylazoxime-ethenyl.
Benzethylamide.
Benzethyleneamide.
Benzhydrazide.
Benzhydrol.
Benzoic acid.
Benzoindicarboxylic acid.
Benzomethylamide.
Benzophenone.
Benzoylazoimide.
p-Benzoylbenzoic acid.
Benzoylhydrazines.
Benzylamine.
Benzylanisidine.
Benzylchloraniline.
Benzylic methylic sulphide.
Benzyl-*p*-phenetidine.
Benzyltoluidines.
Butyric acid.
Camphor.
Carbazole.
Carbostyril.
Carboxyamidobenzoic acid.
Carvacrol.
Catechol.
Cymidine.
Dibenzyltetrazole.
Dihydroxydibenzoyldihydropyrazine,
Dihydroxynaphthalene.
Dimethylamine.
Dimethylaniline.
Dimethyltolylenediamine.
Diphenyl.
Diphenylamine.
Diphenylpropionic acid.
Durene.

Amino-derivatives. See :—
  Formic acid.
  Guanidine.
  Hexahydrophenylaminoacetic acid.
  cis-Hexahydro-*p*-toluic acid.
  cyclo-Hexane.
  4-Hydroxybenzoic acid.
  Hydroxydiphenylamine.
  Hydroxynaphthalenesulphonic acids.
  Hydroxynaphthoic acid.
  Hydroxyphenazine.
  Hydroxyquinoline.
  Indole- 2′-carboxylic acid.
  Menthol.
  Menthone.
  Methanedisulphonic acid.
  p-Methoxydiphenylamine.
  Methoxyphenazine.
  3-Methoxyquinoline.
  Methylaniline, nitro-.
  Methylbenzylamine.
  Methylbenzylbenzamide.
  Methylethenylphenylene-amidine.
  3-Methylindazole.
  3-Methyl-5-*iso*-propylbenzene.
  Methylthiazolecarboxylic acid.
  Naphthaquinoneoxime.
  sym-Naphthazine.
  Naphthoic acid.
  Naphthol.
  Naphtholsulphonic acid.
  Naphthylbenzylhydrazine.
  Octoic acid.
  Orcinol.
  Oxalic acid.
  Pentamethylenetetramine.
  Penthiazoline.
  Phenol.
  Phenolphthalein.
  Phenoxazonecarboxylic acid.
  p-Phenoxybenzoic acid.
  Phenyl *p*-tolyl ketone.
  Phenylxylyl ketones.
  Phenylazimidobenzene.
  Phenylaminoazimidobenzene.
  Phenylbenzoic acid.
  Phenylbenzylhydrazine.
  Phenylbenzylidenehydrazone.
  Phenylcinnamic acid.
  Phenylcrotonic acid.
  5-Phenyl-2 : 6-dibenzyl-*m*-diazine.
  Phenylic ether.
  Phenylimido-β-butyric acid.
  Phenylinduline.
  Phenylmercaptan.
  α-Phenylpyridine.
  p-Tolyl-*o*-phenylenediamine.
  Phenyltolylsulphone.
  Propionic acid (under α-Alanine).
  Quinoline.
  Tetramethyldiphenyl.

Amino-derivatives. See :—
  Tetrazole.
  Thymol.
  Toluene.
  Tri-methylenetriamine.
  2 : 2 : 6-Trimethylpiperidine.
  Uracyl hydrosulphide.
  Uramidobenzoic acid.
  Xylylene*exo*diamine.
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  - chromous carbonate (Baugé), A., ii, 426.
  - chloride, apparatus for demonstrating the volumetric composition of (Carnegie and Wales), A., ii, 558.
    - freezing points of dilute solutions of (Loomis), A., ii, 352.
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  - cuprous chlorides (Wells and Hurlburt), A., ii, 107.
  - iodide, thermochemical data of the action of mercuric cyanide on (Varet), A., ii, 148.
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  - nitrate, thermal expansion of solutions of (de Lannoy), A., ii, 233.
    - freezing points of dilute solutions of (Loomis), A., ii, 352.
  - sulphide, exclusion of, from qualitative analysis (Tarugi), A., ii, 391.
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- *iso*-Amylamine, action of carbon bisulphide on (Ponzio), A., i, 636.
- Amylamines (Berg), A., i, 8.
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Amylmalonic acid, amylic salt, rotatory power of (Guye and Goudet), A., ii, 135.
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iso-Amyl-ψ-nitrole. See *as*-Dimethylpropylpseudonitrole.
  See *iso*-Pentane, β-nitro-β-nitroso-.
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Amyloxamic acid, amylamine salt (Berg), A., i, 8.
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Azoxyphenyl *m*-xylyl ketone. See Phenyl *m*-xylyl ketone, azoxy-.

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  Benzeneazimidole.
  Benzene-4-azo-2-acetamidophenol.
  Benzene-4-azo-2-aminophenol.
  Benzeneazo-*m*-cresetoil.
  Benzeneazo-*o*-cresetoil.
  Benzeneazocyanacetic acid.
  Benzeneazoethane.
  Benzeneazoguaiacol.
  Benzeneazoimidoformyl cyanide.
  Benzeneazophenetoil.
  Benzeneazoresorcinoloxime.
  Benzeneazosalicylic acid.
  Benzeneazoximidoresorcinol.
  Benzenediazonium derivatives.
  Benzenediazosulphonic acid.
  Benzene-6 : 1-diazoxide.
  Benzenylazoximeethenyl.

Azo-compounds. See:—
  Benzoyl-*p*-hydroxyazobenzene.
  Benzylideneazine.
  Carbohydrazimine.
  m-Cresolbisazo-*o*-toluene.
  m-Cresolbisazo-*m*-toluene.
  m-Cresolbisazo-*p*-toluene.
  Diazoacetophenone.
  Diazoaminobenzene.
  Diazoaminosulphanilic acid.
  Diazobenzene.
  Diazobenzene anhydride.
  Diazobenzenemercaptan hydrosulphide.
  Diazobenzene sulphide.
  Diazobenzene bisulphide.
  iso-Diazobenzene hydroxide.
  Diazobenzenehydroxyamidobenzyl.
  Diazobenzenehydroxyamidomethane.
  Diazobenzeneimide.
  Diazobenzenesulphonic acid.
  iso-Diazobenzenesulphonic acid.
  Diazobenzenethiophenyl ether.
  Diazo-*p*-chlorobenzene tribromide.
  Diazohydroxyamidobenzene.
  Diazomesitylene iodide.
  Diazomethanedisulphonic acid.
  Diazoniumanthranilic acid.
  Diazoperhaloids.
  Diazophenol hydrosulphides.
  Diazophenols.
  Diazophenolsulphonic acids.
  p-Diazo-*p*-phenoxybenzoic acid.
  Diazophenylinduline.
  Diazopiperonylacetone.
  Diazosalicylic acid.
  Diazosulphanilic acid thiophenyl ether.
  Diazotoluene.
  Diazotoluene anhydride.
  iso-Diazo-*p*-toluene.
  6 : 1-Diazoxy-2-anisoil.
  3 : 2-Diazoxyphenol.
  iso-Dihydrotetrazine.
  Dimethylazobenzenes.
  Diphenyleneazone.
  Disazo-compound, $C_{14}H_{12}N_4$, obtained from *m*-aminobenzoic acid.
  Formazyl hydride.
  Formazyl-*p*-hydroxybenzene.
  Formazyl-*p*-methoxybenzene.
  Hydroxydiazonaphthalenesulphonic acid.
  Malonenediazoximedibenzenyl.
  Malonenediazoxime-ethenyl.
  Mesityldiazonium triiodide.
  Methylazobenzenes.
  Methylethenyldiazophenylenamidine.
  1 : 2 : 3-Naphthaleneazohydroxynaphthoic acid.
  β-Naphthylazocarboxylamide.
  o- and *p*-Phenetoilazo-*p*-phenetoils.

Azo-compounds. See :—
- *o*-, *m*-, and *p*-Phenetoilazo-*p*-phenols.
- Phenylazocarbonanilide.
- Phenylazocarboxylic acid and amide.
- Phenyldiazosulphonic acid.
- Phenyl-*p*-diazotolylsulphone.
- Phenylmethylpyrazoloneazobenzene.
- Phenyl-*α*-*p*-nitrophenyl-*h*-phenylmethylformazyl.
- Phenylthiodiazobenzene.
- Tetramethylazoxyaniline.
- Tetramethyldiamino-*α*-azonaphthalene.
- Tetrazine.
- Tetrethyldiamino-*α*-azonaphthalene.
- *o*-, *m*-, and *p*-Tolueneazo-*o*-cresetoils.
- *o*-, *m*-, and *p*-Tolueneazo-*m*-cresetoils.
- *m*-Tolueneazo-*o*-cresol.
- *o*-, *m*-, and *p*-Tolueneazo-*m*-cresols.
- *o*-, *m*-, and *p*-Tolueneazophenetoils.
- *p*-Tolueneazophenol.
- *p*-Toluenediazoamidobenzenesulphonic acid.
- Trimethylazoxyaniline.
- *m*-Xyleneazophenetoil.
- *m*-Xyleneazophenol.
- Azoimides :—
  - Benzoylazoimide.
  - Glycolylazoimide.
  - Hippurylazoimide.
  - *o*-, *m*-, and *p*-Hydroxybenzoylazoimides.
  - Malonylazoimide.
  - Phenylazoimide.
  - Phenylcarbamazoimide.
  - *iso*-Phthalylazoimide.
  - Succinylazoimide.
  - Terephthalylazoimide.
  - *bis*-Toluenediazoimide.
- Hydrazo compounds :—
  - Acetaldehydephenylhydrazone.
  - Acetoacetonylhydrazide.
  - Acetohippurylhydrazide.
  - Acetohippurylphenylhydrazide.
  - Acetohydrazide.
  - Acetonyl - *o* - benzoicsulphinidehydrazone.
  - Acetylbutylic alcohol, phenylhydrazone of.
  - Acid, $C_{15}H_{20}O_2$, phenylhydrazide of.
  - Aldehydocitrazinic acid, phenylhydrazine derivative of.
  - Anisaldehydehydrazone.
  - Anisylglyoxylic acid hydrazone.
  - Arabinose, ethyl-, amyl-, allyl-, benzyl-, and naphthyl- hydrazones of.
  - Benzaldehydephenylhydrazone.
  - Benzhydrazide.
  - Benzoindicarboxylic acid, osazone of.

Azo-compounds. See :—
  - Benzoylcoumaronehydrazone.
  - Benzoylmethylic phenylic ether phenylhydrazone.
  - Benzoylveratrolphenylhydrazone.
  - Desylacetophenonehydrazide.
  - Diazobenzenebenzoylhydrazine.
  - Diazobenzenephenylhydrazonemethanedisulphonic acid.
  - Dibenzylhydrazine.
  - Dicarboxyphenylglyoxylic acid phenylhydrazone.
  - Diphenylhydrazine.
  - Dihippurylhydrazine.
  - Dimethylhydrazobenzenes, 2 : 4- and 4 : 3′-.
  - 2 : 6-Dimethyloctan-3-onoic acid, carbazone of.
  - Diphenylcarbazidedicarboxylic acid.
  - Diphenylene-*o*-dihydrazine.
  - Diphenyl-4 : 5-octanedione, diphenylhydrazone of.
  - Ethoxyphenylhydrazine.
  - Fluorenonephenylhydrazone.
  - Galactose, ethyl-, amyl-, benzyl-, allyl-, and naphthyl- hydrazones of.
  - Glucose, ethyl-, amyl-, benzyl-, allyl-, and naphthyl-hydrazones of.
  - Hippurylcinnamylidenehydrazine.
  - Hippurylhydrazine.
  - Hydrazioxalyl.
  - Hydrazobenzene.
  - Hydrazonephenylglyoxylic acid.
  - *p*-Hydrazophenylic ether.
  - Hydroxynaphthalenesulphonic acid, hydrazo-.
  - Hydroxyphenylethyl propyl ketone phenylhydrazone.
  - Hydroxystyryl propyl ketone phenylhydrazone.
  - Lactose, ethyl-, amyl-, allyl-, benzyl-, and naphthyl-hydrazones of.
  - *β*-Lactylphenylhydrazide.
  - Mannose, ethyl-, amyl-, allyl-, benzyl-, and naphthyl-hydrazones of.
  - Menthonementhylhydrazone.
  - Menthylhydrazine.
  - Methoxybenzaldehydehydrazone.
  - *o*-Methoxybenzophenonephenylhydrazone.
  - Methylanilidobutyl ketone phenylhydrazone.
  - Methylacetonedicarboxylic acid phenylhydrazone, methylic salt of
  - 3-Methyl-5-*iso*butyl-Δ_2-*cyclo*hexenone and its carboxylic acids, phenylhydrazones of.

Azo-compounds. See :—
- Methylbutylhydrazine.
- 3-Methyl-5-hexyl-Δ_2-*cyclo*hexenone and its carboxylic acids, phenylhydrazones of.
- Methylhydrazobenzenes.
- α-Methylphenylhydrazine.
- Methylpropylbenzaldehydehydrazone.
- Naphthylbenzylhydrazine.
- Oxydimethylnaphthol phenylhydrazone.
- Phenacyl-*o*-benzoicsulphinidehydrazone.
- Phenylaminobenzylhydrazine.
- Phenylbenzylidenehydrazone.
- Phenylbenzylidenemethylhydrazine.
- Phenyl*iso*butylidenehydrazine.
- Phenylformylhydrazide.
- Phenylhydrazine.
- Phenylhydrazinedisulphonic acid.
- Phenylhydrazinoacetamide.
- Phenyhydrazinoacetanilide.
- Phenyhydrazinoacetophenylhydrazide.
- Phenylhydrazinoformic acid.
- β-Phenylhydrazinopropionic acid.
- Phenylhydrazonemethanedisulphonic acid.
- Phenyl hydroxystyryl ketones, phenylhydrazones of.
- Phenylmethyl*iso*butylidenehydrazine.
- Phenylmethylhydrazine.
- Phenyl *p*-tolyl ketone phenylhydrazone.
- Phthalylhydrazide.
- *iso*-Phthalylhydrazide.
- α-Pinonic acid, hydrazone of.
- 5-*iso*-Propylheptan-2-onoic acid, phenylhydrazone.
- Pyrazolonephenylhydrazone and *p*-tolylhydrazone.
- Pyridineacetonephenylhydrazone.
- Quinonemonophenylbenzoylhydrazone.
- *iso*-Rhamnonic acid phenylhydrazide.
- Rhamnose, ethyl-, amyl-, allyl- benzyl-, and naphthyl-hydrazones of.
- *iso*-Rhamnosephenylhydrazone.
- Sulphohydrazimethylenecarboxylic acid.
- Terephthalylhydrazidacetoacetic acid.
- Terephthalylhydrazide.
- *p*-Tolylglyoxylic acid hydrazone.
- Tropinonephenylhydrazone.
- Veratraldehydehydrazone.
- Veratroylglyoxylic acid hydrazone.

Azo-compounds. See :—
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- Semicarbazides or semicarbazones :—
  - Diphenylsemicarbazide.
  - Diphenylthiosemicarbazide.
  - *d*- and *l*-Menthonesemicarbazones.
  - Phenylacetonylsemicarbazide.
  - Phenylacetylsemicarbazide.
  - Phenylbenzoylsemicarbazide.
  - Phenylcarboxyethylsemithiocarbazide.
  - Phenylsemicarbazides.
  - Phenylsemicarbazidecarboxylic acid.
  - Phenylthiocarbazinic acid bisulphide.
  - Phenylthiosemicarbazide.
  - 5-*iso*-Propylheptan-2-onoic acid semicarbazone.
  - Terpenone, $C_{10}H_{16}O$, semicarbazone of.
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  Acenaphthenone.
  Acetamide.
  Acetamidobenzene.
  Acetamidophenol.
  1-Acetamidoquinoline.
  Acetanilide.
  Acetoacetic acid.
  Acetonyl-*o*-benzoicsulphinide.
  Acetoxime.
  1:2:4-Aceto-*m*-xyleneamide.
  Acetylcarbazole.
  Acetylmalic acid.
  Alizarin.
  Allylene.
  Allylthiocarbamide.
  Amylene and β-*iso*-Amylene.
  Anethoil and *iso*-Anethoil.
  Aniline.
  Anilinesulphonic acids.
  o-Anisidine.
  Anisoil.
  Anthracene.
  Anthraquinones.
  Apiole and *iso*-Apiole.
  Apione.
  Benz*syn*aldoxime.
  Benzamidosulphonic acid.
  Benzene.
  Benzenediazonium.
  Benzenediazoxide.
  Benzenesulphonamide.
  Benzene-*o*-sulphonic acid, cyano-.
  Benzenyloxime.

Bromo-derivatives. See :—
Benzoic acid.
Benzoicsulphinide.
Benzoylcarbazole.
Benzoylhydrazine.
Benzyldibromodiethylamine.
Benzylethylamine.
Benzylic iodide.
iso-Butylacetic acid.
Butylamine.
Butyric acid and *iso*-Butyric acid.
Butyroylmalic acid and *iso*-Butyroylmalic acid.
Camphenone.
Campholide.
Camphor.
Camphoric acid.
Camphoric anhydride.
Carbazole.
Cinnamic acids.
Citraconic acid.
Collidine.
ψ-Cubebin.
ψ-Cumenol.
Dehydrothiotoluidine.
m-Diacetophenylenediamide.
Diazobenzene anhydride.
Diazobenzenephenylhydrazonemethanedisulphonic acid.
Diazobenzenethiophenyl ethers.
Dibenzoylacetylmethane.
Dibenzylhydantoin.
2 : 4-Diethoxyacetophenone.
Diethoxyxylenol.
2 : 4-Dihydroxyacetophenone.
Dihydroxyhexahydrocymenes.
Dihydroxytetramethylstilbene.
3 : 3-Dimethoxybenzophenone.
Dimethoxyquinone.
3 : 3-Dimethoxythiobenzophenone.
Dimethoxytriphenylmethanecarboxylic acid.
Dimethoxyxylenol.
Dimethylaminodiphenazone.
Dimethylaniline.
m- and *p*-Dimethylaniline-*m*-sulphonic acids.
Dimethylbarbituric acid, nitro-.
Dimethylglutaric anhydride.
Dimethylmalonimide.
μ-Dimethylpenthiazoline.
Diphenacyl.
Diphenazone-*o*-hydroxycarboxylic acid.
Diphenoxyquinone.
Diphenyldimethyltetrahydro-γ-pyrone.
Diphenylmethenylamidine.
4 : 5-Diphenyl-2 : 7-octanedione.
Diphenylparaconic acid.
Dipropylacetic acid.
Dipropyl*iso*propylic alcohol.

Bromo-derivatives. See :—
Dithienyl.
Ethoxyanethoil.
2-Ethoxybenzylideneacetone.
Ethoxy-ψ-cumenol.
μ-Ethoxypenthiazoline.
Ethoxyxylenol.
Ethyl-*o*-benzoicsulphinide.
Ethylene.
Ethylketole.
Ethylmesitylene.
p-Ethyltoluene.
p-Ethyltoluenesulphonic acid.
Ethyltriethylphosphonium.
Fluorenone.
Formamidobenzene.
Formanilide.
Formazylsulphonic acid.
Fumaric acid.
Gallic acid.
Heptoic acids.
Hexadecylene.
Hexahydro-*p*-xylic acid.
Hexoic acids.
Hexylene.
Hippenylcarbanil.
Homopiperonylic acid.
Hydrindone.
p-Hydroxybenzaldehyde.
Hydroxybenzaldoxime.
Hydroxybenzoic acid.
o-Hydroxybenzophenone.
Hydroxybenzylideneacetone acetate and Benzoate (under the respective acids).
o-Hydroxybenzylidenediacetophenone.
Hydroxybenzylideneaniline.
Hydroxybenzylidenenaphthylamine.
Hydroxybenzylidenetoluidine.
Hydroxy-ψ-cumenol.
Hydroxydimethylglutaric lactone.
Hydroxydiphenylaminecarboxylic acid.
Hydroxynaphthadiphenazone.
Hydroxynaphthylhydroxyphenylamine.
Hydroxyphenyl styryl ketone.
4-Hydroxy-5-phenyl-2 : 6-dibenzyl-*m*-diazine.
Hydroxyquinolines.
Imidocarbonic acid.
Indophenazine.
Ketostearic acid.
β-Lapachone.
Levulinic acid.
Luteolin.
Maleic acid.
Maleic anhydride.
Maleimide.
Maleinanil.
Malein-*p*-tolil.
Maleinuric acid.

Bromo-derivatives. See :—
Malonic acid.
Menthone.
Menthylamine.
Meroquinenine.
Mesaconic acid.
Mesitylene.
Methane.
Methanesulphonepropionic acid.
Methoxy-ψ-cumenol.
Methoxyethoxypropylbenzene.
μ-Methoxypenthiazoline.
Methoxyphenyl ethyl ketone.
Methoxyxylenol.
Methyl hydroxyethyl ketone.
Methylacetoacetic acid.
Methylacetylene.
Methylaniline.
α-Methylbutyric acid (valeric acid).
Methylenecaffeic acid.
μ-Methylpenthiazoline.
Methylisopropylacetylene.
Methyltaurocarbamic acid, chloro-.
Methyl*iso*valeric acid (hexoic acid).
Morin.
Myricetin.
Naphthalene.
Naphthaquinonecarboxylic acid.
Naphthol.
Naphthylaminopenthiazolines.
α-Naphthylic carbonates.
iso-Narcotine.
Opianic acid β-naphthylamine.
Pentacetylmorin.
Pentadecoic acid.
cyclo-Pentene.
Penthiazoline.
Peonol.
Phenol.
Phenolphthalein.
Phenyl-α-coumaryl ketone.
Phenyl hydroxystyryl ketone.
Phenyl tolyl ketones.
Phenylaminobenzylhydrazine.
Phenyldibenzyl-*m*-diazine.
Phenyldihydro-β-phenotriazine.
4′-Phenyldihydroquinazoline.
m-Phenylenediamine.
Phenylenediurethane.
Phenylic ethylic ether.
Phenylic γ-bromopropylic ether.
Phenylketotetrahydroquinazoline.
Phenylmalonic acid.
Phenylmethylaminopenthiazoline.
Phenylnitrobenzylnitrosamine.
Phenylnitromethane.
Phenyl*iso*nitromethane.
Phenylthiotetrahydroquinazolines.
Phthalic acid.
Phthalic anhydride.
iso-Phthalic acid.
Pinic acid.

Bromo-derivatives. See :—
μ-Piperidylpenthiazoline.
Piperonylnitroacetone.
Piperonylonitrile.
Piperylenedicarboxylic acid.
Propaneoxymethane.
Propene.
Propeneoxymethane.
Propine.
Propineoxymethane.
Propionic acid.
Propionylmalic acid.
μ-Propoxypenthiazoline.
Propylbenzene.
Propylene.
Propylenepseudothiocarbamide.
Propylmesitylene.
1-Propylpiperidine, γ-.
Propylthiocarbimide.
Propylthiourea.
Propylvalerolactone.
Protocatechuic acid.
Pyridine.
Pyroxanthine.
Quinoline.
Resacetophenone.
Resorcinol.
Resorcinol diethyl ether.
Ricinin.
Ricininic acid.
Succinamic acid.
Succinanil.
Succinanilic acid.
Succinic acid.
Succino-β-naphthilic acid.
Succino-*p*-tolilic acid.
Sulphamidobenzamide.
3-Sulphamidobenzoic acid.
Sulphobromobenzoic acid.
Sulphochlorobenzoic acid.
Terephthalic acid.
Terpene.
Tetracetylluteolin.
Tetrahydrocarvonebisnitrosylic acid.
Tetrahydrocumic acid.
Tetric acid.
Tetronic acid.
Theophylline.
Thienyltriphenylmethane.
Thiocarbonylacetoacetic acid.
Toluene.
o- and *p*-Tolylaminopenthiazolines.
Tribenzaldehyde.
Tribenzoylmethane.
Trimethylethylammonium.
Trimethylethylene.
ααβ-Trimethylglutaric acid.
Trimethylglutaric anhydride.
Trimethylindolium hydroxide.
Trimethylpropionic acid.
Triresorcinol.
Tropinone.

Bromo-derivatives. See :—
Undecylenic acid (hendecenoic acid).
Valeric acid and *iso*-Valeric acid.
Veratrol.
Vinyl*cyclo*propane.
Xanthine.
Xylenol.
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iso-Butylacetoacetic acid, ethylic salt, rate of formation of (Bischoff), A., i, 85.
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Butylamine, β-bromo-, hydrobromide of (Bookman), A., i, 200.
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γ-chloro- (Bookman), A., i, 200.
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iso-Butylanhydrodibenzilacetoacetic acid (Japp and Lander), T., 740; P., **1895**, 146.
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iso-Butylidenecyanacetic acid (Braun), A., i, 594.
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Butylmalonic acid, ethylic salt, rate of formation of (Bischoff), A., i, 85.
iso-Butylmalonic acid, ethylic salt, rate of formation of (Bischoff), A., i, 85.
  hydrolysis of (Hjelt), A., i, 205, 598.
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ψ-Butylmalonic acid, ethylic salt, rate of formation of (Bischoff), A., i, 85.
Butyloxamic acid, butylamine salt (Berg), A., i, 8.
iso-Butylphthalazine, chloro-, and its picrate and platinochloride (Bromberg), A., i, 580.
1′-*iso*-Butylphthalazone (Bromberg), A., i, 580.
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iso-Butylthiocarbimide, action of hydrogen sulphide on (Ponzio), A., i, 636.
m-*iso*-Butyltoluene, 5-chloro- (Gundlich and Knoevenagel), A., i, 212.
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  methylic salt, heat of evaporation of (Marshall and Ramsay), A., ii, 349.
  phenylic salt, magnetic rotatory power, &c., of (Perkin), T., 1075, 1076, 1078, 1180, 1238.
  estimation of (Wilcox), P., **1895**, 202.
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  α-bromo-, action of hydroxylamine on (Hantzsch and Wild), A., i, 285.
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  ααβ-*tri*chloro-, formation of, from α-chlorocrotonic acids (Valentin), A., i, 79.
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  potassium salt, products of electrolysis of (Hamonet), A., i, 664.
  crotonylic salt (Charon), A., i, 662.
  methylic salt, heat of evaporation of (Marshall and Ramsay), A., ii, 349.
iso-Butyric acid, bromo-, action of finely divided silver on (Hell), A., i, 10.
  α-bromo-, ethylic salt, action of finely divided silver on (Auwers and Ziegler), A., i, 643.
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iso-Butyric chloride, action of mercuric or lead thiocyanate on (Dixon), T., 862; P., **1896**, 100.
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ab-*iso*-Butyryl-α-naphthylthiocarbamide (Dixon), T., 865; P., **1896**, 101.

Butyrylphenylsemicarbazide (Widman), A., i, 630.

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ab-*iso*-Butyrylphenylthiocarbamide (Dixon), T., 862; P., **1896**, 101.

action of silver nitrate on (Dixon), T., 863; P., **1896**, 101.

ab-*iso*-Butyrylphenylurea (Dixon), T., 863; P., **1896**, 101.

iso-Butyrylthiocarbimide (Dixon), T., 862.

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ab-*iso*-Butyryl-*o*-tolylurea (Dixon), T., 863; P., **1896**, 101.

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  Arabinose.
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  Cane-sugar.
  Capsicum seed mucilage.
  Cellulose.
  Dextrin.
  Dextrose (glucose).
  Diglucose.
  Dulcitol and *iso*-Dulcitol.
  Erythrodextrin.
  Fructose (levulose).
  Galactan.
  Galactose.
  α- and β-Galaheptose.
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  Glucoheptitol.
  Glucose (dextrose).
  Glycerose.
  Glycogen.
  Inulin.
  Inulin of garlic.
  Jecorin.
  Lactose.
  Levulose (fructose).
  Lyxose.
  Maltodextrin.
  Maltose and *iso*-Maltose.
  Mannan.
  Mannitol.
  Mannose.
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  Acetamide.
  Acetic acid.
  Acetoacetic acid.
  Acetochloropyridinecarboxylic acid.
  Acetone.
  α-Acetophenylsemicarbazide.
  Acetopicolinic acids.
  Acetopiperidide.
  Acetoxime.
  Acetylmalic acid.
  Anisoil.
  Anthracene.
  Anthracenedisulphonic acid.
  Anthracenesulphonic acid.
  Benzaldehyde.
  Benz*anti*aldoxime.
  Benz*syn*aldoxime.
  Benzamidobenzene.
  Benzanilide.
  Benzene.
  Benzeneazosalicylic acids.
  Benzenediazonium salts.
  Benzenesulphonamide.
  Benzenyloxime.
  Benzobutylamide.
  Benzoformanilide.
  Benzoic acid.
  Benzoylcarbazole.

Chloro-derivatives. See:—
  Butylamines.
  iso-Butylphthalazine.
  m-*iso*-Butyltoluene.
  Caffeine.
  Camphene.
  Camphenephosphonic acid.
  Camphenesulphonic acids.
  Camphopyric anhydride.
  Camphor.
  Camphoric acids.
  Camphoric anhydride.
  Camphydrene.
  Carbazole.
  Carbonic acid.
  Crotonamide and *iso*-Crotonamide.
  β-Crotonanilide and *iso*-Crotonanilide.
  Crotonic acid and *iso*-Crotonic acid.
  iso-Crotonic chloride.
  Crotonic-α-naphthylamide.
  iso-Crotonic-α-naphthylamide.
  Cymene.
  Cymenesulphonic acids.
  Diamyloxyquinol.
  Diamyloxyquinone.
  Diamyloxyquinonediamylhemiacetal.
  Diazoaminobenzene.
  Diazobenzene anhydride.
  Diazobenzenethiophenyl ethers.
  Dibenzyloxyquinol.
  Dibenzyloxyquinone.
  Dibutylamine.
  3 : 3-Diethoxybenzophenones.
  Diethoxyquinol.
  Diethoxyquinone.
  Diethoxyquinonediethylhemiacetal.
  3 : 3-Diethoxythiobenzophenones.
  Dihydrocymene.
  Dihydrometacymene (1-methyl-3-*iso*-propyl*cyclo*hexadiene).
  2 : 4-Dihydroxyacetophenone.
  3 : 4-Dihydroxyquinoline.
  αγ-Diketopyrhydrindene.
  Dimethoxyquinol.
  Dimethoxyquinonediethylhemiacetal.
  Dimethoxyquinonedimethylhemiacetal.
  Dimethoxyquinone.
  3 : 3-Dimethoxybenzophenone.
  3 : 3-Dimethoxythiobenzophenone.
  Dimethylbarbituric acid.
  Dimethylmalonimide.
  Dioxymethylpurin.
  Diphenoxyquinone.
  Diphenyl.
  Diphenylamine.
  Diphenylformamidine.
  Diphenylmethane, *o*-cyano-.
  Diphenylsulphoxide.
  Dipropylicpropional.
  Dithienyl.
  Ethylic ether.

Chloro-derivatives. See:—
  Ethylideneanthranilic acid.
  p-Ethyltoluene.
  p-Ethyltoluenesulphonic acid.
  p-Ethyltoluenesulphonic chloride.
  Fluoflavine.
  Fluorenone.
  Formamidobenzene.
  Formanilide.
  Formic acid.
  Formo-*p*-toluidide.
  Fumaric acid.
  Gallic acid.
  Glyoxylic acid.
  Guaiacol.
  Hexahydrocymene.
  m-Hexyltoluene.
  Hydrolapachol.
  Hydroxybenzylphenazone.
  Hydroxyethylphenazone.
  Hydroxymethylphenazone.
  α-Hydroxypropionic acid.
  α-Hydroxypyrindone.
  1-Hydroxyquinolinephenazine.
  Hydroxyquinolinequinones.
  Hydroxyquinolines.
  Indophenazine.
  Isatin.
  Isatinsemicarbazone.
  Ketopentene.
  αγ-Ketopyrhydrindenecarboxylic acid.
  Ketostearic acid.
  Lactic acid.
  Maleic acid.
  Maleinuric acid.
  Malonic acid.
  Methane.
  Methanesulphonepropionic acid.
  Methenyl-*o*-aminothiophenol.
  3-Methoxyquinoline.
  1-Methyl-3-*iso*butyl*cyclo*hexadiene.
  α-Methylbutyric acid.
  α-Methylbutyric chloride.
  iso-Cyanuric acid, methylic salt.
  1-Methyl-3-hexyl*cyclo*hexadiene.
  Methylindazole.
  1-Methyl-3-*iso*propyl*cyclo*hexadiene.
  Methylpurin.
  Methyltaurocarbamic acid.
  Methyltriethylphosphonium chloride.
  Naphthalenesulphonic acids.
  Naphthol.
  α-Naphthylic carbonate.
  Oxymethylpurin.
  Oxyvinylpicolinic acid.
  cyclo-Pentene.
  Phenol.
  Phenyl tolyl ketone.
  Phenylaminobenzylhydrazine.
  Phenyldibenzyl-*m*-diazine.
  Phenyldihydro-β-phenotriazine.
  Phenylic sulphide.

Chloro-derivatives. See :—
  2′-Phenylindazole.
  Phenylketotetrahydroquinazoline.
  Phenylnitrobenzylnitrosamine.
  β-Phenylpropionic acid.
  Phenylisopropylacetic acids.
  2-Phenylpyridine.
  4′-Phenylquinazoline.
  Phenylthiotetrahydroquinazoline.
  iso-Phthalic acid.
  Propaldehyde.
  Propane.
  Propylene.
  Propylic ether.
  1′-Propylphthalazine.
  1-Propylpiperidine.
  1′ : 3′-Propyl*iso*quinoline.
  Pulegone.
  Pyrhydrindone.
  Pyrindone.
  Pyrogallol.
  Quinazoline.
  Quinoline.
  Quinolinephenazine.
  3 : 4-Quinolinequinone.
  Quinonedimalonic acid.
  Quinoxaline.
  Resorcinol.
  Ricinin.
  Succinic acid.
  Sulphochlorobenzoic chloride,
  Terephthalic acid.
  Tetrahydrocymene.
  5 : 5 : 5 : 5-Tetramethoxytetraphenylethylene.
  5 : 5 : 5 : 5-Tetrethoxytetraphenylethylene.
  Theophylline.
  Thienyltriphenylmethane.
  Toluene.
  Toluenesulphonamide.
  m- and *p*-Toluic acids.
  Toluquinone.
  1 : 3 : 4-Triketohydroquinoline.
  Veratrole.
  Vinylpyridinecarboxylic acid.
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  Xylidine.
  Xyloquinone.
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  p-Bidiphenyl.
  iso-Butenylbenzene.
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I'Sano seeds, fatty acids from (Hébert), A., i, 638.
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Itaconic acid, sublimation temperature under small pressure of (Krafft and Dÿes), A., ii, 89.
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  ethylic salt, action of alcoholic ammonia on (Körner and Menozzi), A., i, 205.

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Ketoglycol, $C_{10}H_{18}O_3$, from dihydrocarvone: its oxime and semicarbazone (Wallach), A., i, 102.
Ketohexamethylenecarboxylic acids. See *cyclo*-Hexanonecarboxylic acids.

Ketohydrazones (Curtius), A., i, 339.

Ketoketoximebehenic acid (Spieckermann), A., i, 410.

Ketone obtained by oxidation of brom*iso*anethoil; and its compounds with ammonia and with potassium acetate (Hell and Gaab), A., i, 293.
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Ketone, $C_8H_{14}O$, derived from dihydro*cis*campholytamide (Noyes), A., i, 696.
  $C_9H_{14}O_2$, from dihydrocarvone: its oxime and semicarbazone (Wallach), A., i, 102.
  $C_9H_{16}O$, from oxidation product of pulegenic acid, and its carbazone, and oxime (Wallach), A., i, 311.
  $C_{10}H_9O_2Br_3$, from dibromanethoil dibromide. See Anethoil dibromide.
  $C_{10}H_{10}O_2Br_2$, from bromanethoil dibromide, and its aniline derivative (Hell and Günthert), A., i, 20.
  $C_{10}H_{10}O_3$, from *iso*safrole, and its oxime (Wallach and Pond), A., i, 95.
  $C_{10}H_{11}O_2Br$, from anethoil dibromide, and its ammonia derivative (Hell and Günthert), A., i, 21.
  $C_{10}H_{14}O_4$, from *iso*-amylacetylacetone and its sodium hydroxide (Barbier and Bouveault), A., i, 638.
  $C_{10}H_{16}O$, from pinole tribromide: its oxime and semicarbazone (Wallach), A., i, 102.
  $C_{10}H_{16}O$, from methyl*cyclo*hexenone and acetone (Wallach), A., i, 572.
  $C_{10}H_{18}O$, from phellandrene nitrite: its *d*-oxime and semicarbazone (Wallach and Herbig), A., i, 101.
  $C_{12}H_{16}O_3$, from methyl*iso*eugenol, and its oxime and semicarbazone (Wallach and Pond), A., i, 95.
  $C_{14}H_{22}O$, from methyl*cyclo*hexenone: its hydrochloride, hydrobromide, and oxime (Wallach), A., i, 572.
  $C_{17}H_{16}O$, formed by condensation of cinnamylideneacetone with benzaldehyde (Scholtz), A., i, 368.

Ketone-alcohol, $C_{10}H_{18}O_2$, from the oxidation of menthene (Tolloczko), A., i, 381.

Ketone-group of natural dye stuffs (Perkin), T., 1440; P., 1896, 167.

Ketones from *iso*eugenol ethyl and methyl ether dibromides (Hell), A., i, 169.
  formation of, by union of water with acetylene hydrocarbons (Desgrez), A., i, 2.
  ortho-, action of hydrazine on (Curtius), A., i, 339.
  action of zinc and ethylic chloracetate on (Reformatsky), A., i, 128.
  reduction of, by aluminium (Wislicenus), A., i, 672.
  bromo-, from anethoil dibromide and bromanethoil dibromide (Hell), A., i, 170.

Ketones and Quinones. See also:—
  Acenaphthenone.
  Acetomesitylene.
  Acetone.
  Acetonyl-*o*-benzoicsulphinide.
  Acetophenone.
  Acetophenone, cyano-.
  Acetylacetone.
  Acetylbenzyl methyl ketone.
  Acetylbisnitrosodimethylnaphthalene.
  Acetyldihydrodiduroquinone.
  Acetyldihydroxydimethylnaphthalene.
  Acetyldihydroxyflavone.
  Acetyldiduroquinone.
  Acetyldurene and Acetyl*iso*durene.
  Acetylhydroxyquinolinequinone.
  Acetylmesitylene.
  Acetylpentamethylbenzene.
  Acetylphorone.
  Acetyl*iso*propylketopentamethylene.
  Adipinketone.
  Anhydroglycopyrogallol.
  Anhydroglycoresorcinol.
  Anilidotoluquinone.
  Anisic acetone.
  Anisyl ethyl ketone.
  Anthraquinone.
  Azoxyphenyl-*p*-tolyl ketone.
  Benzophenone.
  Benzopinacolin.
  Benzoylbenzoylacetomethane.
  Benzoylcoumarone.
  Benzoyldiacetylmethane.
  Benzoyldiduroquinone.
  Benzoylmesitylene.
  Benzoyl-3-methyl-5-isobutyl-Δ_2-*cyclo*hexenone.
  Benzoyl-3-methyl-5-hexyl-Δ_2-*cyclo*hexenone.
  Benzoylmethylic phenylic ether.
  Benzoylmethylresorcinol.
  Benzoylvanillin.
  Benzoylveratrole.

Ketones and Quinones. See :—
  Benzyl methyl ketone.
  Benzyldesmotroposantonin.
  1′ : 3′-Benzylethylphthalazone.
  Benzylideneacenaphthenone.
  Benzylideneacetone.
  Benzylideneacetophenone.
  Benzylideneanhydroglycogallol.
  Benzylidenediacetophenone.
  Benzylidene-eucarvone.
  Benzylidenementhone.
  Benzylidenemethylhexenone.
  Benzylidenemethylketo*iso*oxalone.
  Benzylidene*cyclo*pentanones.
  Benzylidenepulegone.
  Benzylidenetriacetophenone.
  1′ : 3′-Benzylmethylphthalazone.
  Benzylrosindone.
  1′-*iso*-Butylphthalazone.
  Camphenone.
  Camphor.
  Camphorone.
  Camphorquinone.
  Chloranil.
  Chrysoketone.
  Coumarone.
  Cymophenone and *p*-Cymoquinone.
  Desylacetophenone.
  Diacenaphthylidenone.
  Diacetophenone.
  Diacetyl dicyanide.
  Diacetylacetone.
  Diacetyldianthranol.
  Diacetyldurene.
  Diacetyl*iso*durene.
  Diacetylmesitylene.
  Diacetylresacetophenone.
  Diallylacetone.
  Di*iso*amylaminoacetone.
  Diamyloxyquinone.
  Dianilidotoluquinone.
  Dianisylidene*cyclo*pentanone.
  Diazoacetophenone.
  Diazopiperonylacetone.
  α- and β-Dibenzoylacetylmethanes.
  Dibenzoylbisphenylenemethylpyrazolone.
  Dibenzoylmesitylene.
  Dibenzoylphenylmethane.
  Dibenzylidene*cyclo*hexanone.
  Dibenzylidenemethylhexenone.
  Dibenzylidenemethylpentenone.
  Dibenzylidenesuberone.
  Dibenzylidenetriacetophenone.
  Dibenzyloxyquinone.
  Di*iso*butylaminoacetone.
  Di*iso*butyl ketone.
  Dibutyroyl.
  Dicinnamylidene*cyclo*pentanone.
  Diduroquinone.
  3 : 3-Diethoxybenzophenone.

Ketones and Quinones. See :—
  Diethoxybenzylidenetriacetophenone.
  3 : 3-Diethoxy-4 : 4-dimethylbenzophenone.
  Diethyl diketone.
  Diethyl ketone.
  Difurfurylidene*cyclo*hexanone.
  Difurfurylidene*cyclo*pentanone.
  Difurfurylidenetriacetophenone.
  Dihydrohippuroflavin.
  Dihydroxyacetophenone.
  Dihydroxybenzophenone.
  Dihydroxyflavone.
  Dihydroxy-β-naphthaquinone.
  Diketone from quercitol.
  Diketopiperazine.
  Dimesityldinitrosacyl.
  3 : 3-Dimethoxybenzophenone.
  Dimethyl ketone.
  Dimethylacetylacetone.
  Dimethylaminoacetone.
  Dimethylbenzoylpropionic acid.
  2 : 5-Dimethylhexan-3-ol-4-one.
  1 : 3-Dimethyl*cyclo*hexanone.
  Dimethylnaphthol.
  1 : 3-Dimethyl*cyclo*pentanone.
  Diphenacyl.
  Diphenacyl ethylene diketone.
  Diphenoxyquinone.
  Diphenylacetophenone.
  Diphenyldimethyltetrahydro-γ-pyrone.
  Diphenyldiphenylenepinacolin.
  Diphenylene ketones.
  4 : 5-Diphenyl-2 : 7-octanedione.
  Diphenyloxetone.
  Diphenyl*cyclo*pentenone.
  1 : 3-Diphenyl*iso*tetrazolone.
  Dipiperonaltriacetophenone.
  Dipropionyl.
  Dipropionyldurene.
  Dipropionylmesitylene.
  4 : 4-Dipropoxybenzophenone.
  Dipropyl ketone.
  Di*iso*propyl ketone.
  Dipropylaminoacetone.
  Di-*p*-tolyl benzylidenedimethyl diketone.
  Di-*p*-tolyl furfurylidenedimethyl diketone.
  Di*iso*valeryl.
  Duroquinone.
  Ethoxybenzylideneacetone.
  Ethoxybenzylideneacetophenone.
  2 : 5-Ethoxyphenyl- 3 : 4-dithiobiazolone.
  Ethyl *iso*-propyl ketone.
  Ethylbenzoylpropionic acid.
  Fenchone.
  Furfurylideneacetophenones.
  Gallacetophenone.

Ketones and Quinones. See :—
cyclo-Hexanone-1-carboxylic acid.
Hippuroflavin.
Hydracetylacetone.
Hydrindone.
Hydrolapachol.
o- and *p*-Hydroxybenzophenones.
Hydroxybenzylideneacetophenone.
Hydroxydihydrocarvone.
Hydroxydimethoxycoumarincarboxylic acid.
1-Hydroxy-1 : 2-diphenyl*cyclo*pentan-4-one.
Hydroxyhydrolapachol.
Hydroxy*iso*lapachol.
Hydroxylapachone.
β-Hydroxy-*a*-naphthaquinone.
p-Hydroxyphenyl *p*-tolyl ketone.
Hydroxyphenylethyl propyl ketone.
Hydroxystyryl propyl ketone.
a-Keto-*β*-pentene.
Ketopiperazine.
Lapachol.
Lapachone.
Menthone.
Mesityl methyl ketone.
Mesitylic oxide.
o-Methoxybenzophenone.
Methoxyphenyl ethyl ketone.
Methoxyphenylketotetrahydroquinazoline.
Methyl benzamidobutyl ketone.
Methyl butyl ketone.
Methyl *iso*-butyl ketone.
Methyl *sec-iso*butyl ketone.
Methyl ethyl ketone.
Methyl hexyl ketone.
Methyl hydroxyethyl ketone.
Methyl propenyl ketone.
Methyl propyl ketone.
Methyl *iso*propyl ketone.
Methyl propylidenethyl ketone.
Methylamylaminoacetone.
Methylbenzoylpropionic acid.
Methylbutylaminoacetone.
1-Methyl-3-*iso*butyl*cyclo*hexanone.
3 : 5-Methyl*iso*butyl-Δ_2-*cyclo*hexenone.
Methylisobutyrylketopentamethylene.
Methylheptenone.
1-Methyl*cyclo*hexanone.
Methyl*cyclo*hexenone.
3-Methyl-5-hexyl-Δ_2-*cyclo*hexenone.
β-Methylketopentamethylene.
Methylketo*iso*xalone.
1-Methyl-3-*iso*propyl*cyclo*hexanone.
3-Methyl-5-*iso*propyl-Δ_2-*cyclo*hexenone.
Naphthaquinonecarboxylic acid.
Nopinone.
Peonol.

Ketones and Quinones. See :—
Phenacyl bromide.
Phenacyl-*o*-benzoicsulphinide.
Phenetylketotetrahydroquinazoline.
Phenyl *a*-coumaryl ketone.
Phenyl *m*-ethoxystyryl ketone.
Phenyl ethyl ketone.
Phenyl hydroxystyryl ketones.
Phenyl styryl ketone.
Phenyl tolyl ketones.
Phenyl *p*-tolyl phenylene diketone.
Phenyl *m*-xylyl ketone.
Phenyl *o*-xylyl ketone.
Phenyl *p*-xylyl ketone.
Phenylacetone (*benzyl methyl ketone*).
5-Phenyl-3 : 4-dithiobiazolone.
Phenylketotetrahydroquinazoline.
Phenylmethylketotetrahydropyridazinecarboxylic acid.
Phenylpropyltetrahydroazindone.
4-Phenylquinazolone.
4′-Phenyltetrahydroquinazolone.
iso-Phorone.
Pinacolin.
Piperonalacetophenone.
Piperonylacetone.
Propionyldurene.
Propionylmesitylene.
iso-Propylbenzoquinone.
iso-Propylbenzoylpropionic acid.
iso-Propylfurfuran-naphthaquinone.
iso-Propylheptanonoic acid.
1′-Propylphthalazone.
Pulegone.
Resacetophenone.
Styryl methyl ketone.
Tetracetylethane.
Tetrahydroacetophenone.
1-*β*-Tetranaphthyl-3-cyanotrimethylpiperidone.
Tetraphenoxyquinone.
Tetraphenylenepinacolin.
o- and *m*-Toluidotoluquinones.
Toluquinone.
p-Tolyl *a*-coumaryl ketone.
p-Tolyl furfurylidenemethyl ketone.
p-Tolyl *o*-hydroxystyryl ketone.
p-Tolyl styryl ketone.
Tolylketoindene.
Tribenzoylmethane.
Trihydroxybenzophenone.
Trihydroxyxanthone.
Trimethoxycoumarin.
Trimethoxycoumarincarboxylic acid.
1′ : 3′ : 3′-Trimethyl-2′-indolinone.
Trimethylketohexamethylene.
Tri-*p*-tolyldibenzylidenetrimethyltriketone.
Tropinone.
Tropinonecyanhydrin.
iso-Valerophenone-*o*-carboxylic acid.

- Ketones and Quinones. See :—
  - Xanthone.
  - *m*-Xyloquinone.
  - *p*-Xylyl ketone.
- Ketonic acids, ethereal salts of, action of hydrazine on (Curtius), A., i, 339.
- α-Keto-β-pentene, *hexa*chloro-, reversible conversion of, into hexachlor-α-keto-γ-pentene (Küster), A., ii, 158.
- Ketopinic acid, its methylic, barium, and calcium salts, hydrazone, and oxime (Armstrong), P., **1896**, 167; T., 1401.
- αγ-Ketopyrhydrindenecarboxylic acid, β-*di*chloro-, and its methylic salt (Zincke and Winzheimer), A., i, 500.
- Ketostearamide, hydrolysis of (Behrend), A., i, 410.
- Ketostearic acid (Behrend), A., i, 410.
  - bromo- (Behrend), A., i, 410.
  - chloro-, reduction of (Behrend), A., i, 410.
  - oxime of (Behrend), A., i, 410.
- Ketoterpine from hydroxycarone (von Baeyer), A., i, 246.
- Kidney, causes of secretion by the (Tamann), A., ii, 618.
- Kinoin, non-formation of acid compounds of (Perkin), T., 1440; P., **1896**, 167.
- Kjeldahl's method, estimation of platinochlorides by (van Dam), A., ii, 218.
- Klinozoisite from the Tyrol (Weinschenk), A., ii, 569.
- Knaresborough dropping well, analysis of water of (Burrell), T., 536; P., **1896**, 73.
- Knopite from Alnö, Sweden (Holmquist), A., ii, 313.
- Kola nut, amount of caffeine and theobromine in (Le Bon), A., ii, 64.
- Koprosterol, separation of, from human fæces (Bondzyński), A., ii, 319.
- Koridofu, a preparation of tofu (Inouye), A., ii, 65.
- Kyanite, action of boric acid on (Jannasch), A., ii, 576.
- "Kyanol." See Aniline.

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- Labradorite from the Azores (Fouqué), A., ii, 532.
  - from Bavaria (Schwager and Gümbel), A., ii, 432.
  - from New Zealand (Speight), A., ii, 192.
- Labradorite-bytownite from the Azores and France (Fouqué), A., ii, 532.
- Laccase in germinating seeds (Rey-Pailhade), A., ii, 326.
  - detection of, in vegetables (Bertrand), A., ii, 61.
  - in fungi (Bourquelot and Bertrand), A., ii, 268.
- Lactase of the small intestine (Röhmann and Lappe), A., ii, 43.
  - absence of, in intestinal juice of sheep (Pregl), A., ii, 49.
- Lactic acid, crystallised, of constant boiling point (Krafft and Dyes), A., i, 84.
  - sodium salt, electrolysis of (Walker), T., 1278.
- Lactic acid, *tri*chloro- (Zaharia), A., i, 634.
- *d*-Lactic acid, conversion of, into lævolactic acid (Purdie and Williamson), T., 837; P., **1896**, 97.
  - specific rotation of the ethylic salt of (Purdie and Williamson), T., 827; P., **1896**, 97.
- Lactic acids, lævo- and inactive, rotatory powers of the lævo- and inactive amylic salts of (Walden), A., ii, 139.
- Lactic fermentation, action of metallic salts on (Chassevant), A., ii, 122.
- Lactic nitrile, action of acetic chloride on (Colson), A., i, 283, 284.
- Lactide, refraction equivalent of (Anderlini), A., ii, 229.
- Lactone, $C_8H_{14}O_2$ (Reformatsky), A., i, 129.
  - $C_{10}H_{14}O_2$, derived from *iso*butaldehyde (Franke), A., i, 404
  - $C_{10}H_{14}O_3$, from dibromocampholide, and its bromo-derivative (Forster), T., 43; P., **1895**, 208.
  - $C_{26}H_{16}O_2$, from acid, $C_{26}H_{18}O_3$ (Klinger and Lonnes), A., i, 691.
  - unsaturated, from ceruleonitrosocampholenolide (Béhal and Blaise), A., i, 56.
- Lactone formation in acids of the sugar group, velocity of (Hjelt), A., i, 596.
- Lactones. See also :—
  - Anilido-α-methylbutyrolactone.
  - Butyrolactone.
  - Camphenesulphonic acid.
  - Campholenolide.
  - Campholide.
  - Dihydroxytetraphenylethanedicarboxylic acid, dilactone of.
  - 2 : 6-Dimethyloctan-3-oloic acid, lactone of.
  - Diphenyldibutyrolactone.
  - Ethylvalerolactone.
  - Galaoctonic acid, lactone of.
  - *iso*-Heptenolactone.

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  iso-Hexolactone (*iso-caprolactone*).
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  ω-Hydroxycamphotricarboxylic acid, lactone of.
  Hydroxydibromocamphorsulphonic acid, lactone of.
  2-Hydroxy-2 : 3-diphenyl*cyclo*pentenonylacetic acid, β-lactone of.
  Hydroxylactone, $C_{10}H_{16}O_3$.
  Hydroxymethylcoumalin.
  β-Hydroxymethylpicolinic acid, lactone of.
  β-Hydroxy-ααβ-trimethyladipic acid, lactone of.
  Hydroxytrimethylglutaric lactone.
  Lanoceric acid, lactone of.
  Lyxonolactone.
  Methoethylheptanonolide.
  Methylbutyrolactone.
  p-Methylcarbocaprolactonic acid.
  Octolactone : α-Propylvalerolactone.
  Opianic acid ethylanilic lactone.
  Opianic acid naphthylamic lactones.
  Opianic acid tetrahydroquinaldinic lactone.
  Opianic acid tetrahydroquinolinic lactone.
  Phthalaldehydic acid tetrahydroquinolinic lactone.
  Propylvalerolactone.
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β-Naphthylpiperidine and its hydrochloride, sulphate, aurochloride, and picrate (Roth), A., i, 497.

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  Benzamidobenzonitrile.
  Benzonitrile.
  aa-Dimethyllevulinic acid nitrile.
  Ethyltoluonitrile.
  Hydroxymethylenebenzylic cyanide, carbanilido-derivative of.
  Malononitrile.
  Mandelonitrile.
  α-Naphthonitrile and *β*-Naphthonitrile.
  α-Phenoxybutyronitrile.
  Phthalonitrile.
  Piperonylonitrile.
  Pulegenonitrile.
  Pyrotartaric nitrile.
  o- and *p*-Tolunitriles.
  Veratronitrile.
  Xylidinonitrile.

iso-Nitriles, preparation of (Hofmann Lecture), T., 706.

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  Acetamidocarvacrol.
  Acetamidophenol.
  Acetamidoquinoline.
  Acetamidothymol.
  Acetanilide.
  Acetophenone.
  Alizarin.
  Aniline.
  Anilinobenzoic acid.
  Anilino-*m*-cymene.
  Anilinotoluene.
  Anisaldehyde.
  o-Anisidine.
  Anisoil.
  Azimidobenzene.

Nitro-derivatives. See:—
- Benzaldehyde.
- Benzaldehydephenylhydrazone.
- Benzaldoxime.
- Benzazoimide.
- Benzene.
- Benzeneazoacetamidophenol.
- Benzene-4-azo-2-aminophenol.
- Benzeneazoguaïacol.
- Benzene-2 : 1-diazoxide.
- Benzenediazonium.
- Benzethyleneamide.
- Benzethylimide.
- Benzhydrazide.
- Benzoic acid.
- Benzomethylamide.
- Benzoylazoimide.
- *p*-Benzoylbenzoic acid.
- *p*-Benzoyl-*p*-benzoylbenzoic acid.
- Benzoylsalicylic acid.
- Benzoyl-*o*-toluic and benzoyl-*m*-toluic acids.
- 4-Benzylaniline.
- Benzylanisidine.
- Benzyl-*o*-benzoicsulphinide.
- Benzylic hydrosulphide.
- Benzylic methylic sulphide.
- Benzylideneaminobenzylaniline.
- Benzylideneaminophenylimido-β-butyric acid.
- Benzylideneaniline.
- Benzylidenediaminopentamethylenetetramine.
- Benzylidenephenylhydrazone.
- Benzylmalonic acid.
- Benzylmethylnitramine.
- Benzyl-*o*-sulphamidobenzoic acid.
- Bidiphenylene-ethane.
- *iso*-Butylic alcohol.
- Camphor.
- Campholenolide.
- Carbamide.
- Carbazole.
- Carbostyril.
- Carboxyphenylmalonic acid.
- Carvacrol.
- Catechol.
- Cholesterylic chloride.
- Cresol.
- ψ-Cubebin.
- *m*-Cymene.
- 1 : 3 : 5-Cymidine.
- Decane (di-*iso*-amyl).
- Diazoamidobenzenes.
- Diazobenzene.
- *iso*-Diazobenzene hydroxide.
- Diazobenzenebenzoylhydrazine.
- Diazobenzenehydroxyamidomethane.
- Diazobenzeneimide.
- *bis*-Diazobenzenepentamethylenetetramine.
- Diazobenzenethiophenyl ether.

Nitro-derivatives. See:—
- 6 : 1-Diazoxy-2-anisoil.
- Dibenzamido-*p*-xylene.
- Dibenzophenylethylenediamine.
- Dibenzylacetic acid.
- Dibenzylacetoacetic acid.
- Dibenzylbenzidine.
- Dibenzylcyanoacetic acid.
- Dibenzylhydantoin.
- Dibenzylmalonic acid.
- Dihydroxybutane, tertiary.
- Dimethylaniline.
- Dimethylanilinesulphonic acid.
- Dimethylbarbituric acid.
- Dimethylmalonimide.
- Dimethyloxamide.
- Dimethyltoluidine.
- Diphenyl.
- Diphenylamine.
- Diphenylcarbamide.
- Diphenylguanidine.
- Diphenylmethane.
- Diphenylmethenylamidine.
- βμ-Diphenyloxazole.
- Diphenylsulphoxide.
- Diisopropylmethane.
- Dithienylphenylmethanes.
- Ethane.
- Ethoxyphenylhydrazine.
- Ethylcarbamide.
- Ethylmesitylene.
- Fluorenone.
- Glycerol.
- Guaiacol.
- Guanidine.
- Heptane.
- Hexane.
- Hydrazines.
- 4-Hydroxybenzoic acid.
- Hydroxydiphenylamine.
- Hydroxypyridines.
- 1-Hydroxyquinoline.
- Indole-2′-carboxylic acid.
- Indophenazine.
- Isatinsemicarbazone.
- Menthone.
- Mesidine.
- Mesitylene.
- Mesitylenic acid.
- Methane.
- Methaneazobenzene.
- *p*-Methoxydiphenylamine.
- Methylaniline.
- Methylbenzylamine.
- Methylbenzylbenzamide.
- *m*-Methyl*iso*butylbenzene.
- Methylethenylacetamidophenylenamidine.
- Methylethenylphenylenamidine.
- Methyl-α-ethylpropylmethane.
- *m*-Methylhexylbenzene.
- 3-Methylindazole.

Nitro-derivatives. See :—
  Methyl*iso*azolone.
  1′-Methylquinoline.
  Methyltoluidine.
  Naphthalene.
  Naphthalenedicarboxylic acid.
  a-Naphthol.
  Naphthylbenzylnitrosamine.
  a-Naphthylic carbonate.
  iso-Narcotine.
  Nononaphthene.
  Octane.
  Opianic acid.
  Opianic acid *β*-naphthylamine.
  Opian-*β*-naphthylamic acid.
  Orcinol.
  Pentane.
  Phellandrene.
  Phenol.
  Phenolphthalein.
  p-Phenoxybenzoic acid.
  Phenyl *p*-tolyl ketone.
  Phenyl *p*-tolyl ketoxime.
  Phenyl *p*-tolylphenylene diketone.
  Phenyl *o*-, *m*-, and *p*-xylyl ketones.
  Phenylacetic acid.
  Phenylazimidobenzene.
  Phenylbenzoic acid.
  Phenylbenzoylsemicarbazide.
  Phenylbenzylnitrosamine.
  Phenylcinnamic acid.
  Phenyldiazosulphonic acid.
  Phenylenaceticpropionic acid.
  Phenylethylmethane.
  Phenylhydrazine.
  Phenylhydrazinedisulphonic acid.
  Phenylic bisulphide.
  Phenylic ether.
  Phenylmalonic acid.
    bromo-.
  Phenylmethane.
  1 : 3-Phenylmethylpyrazolone-4-azobenzene.
  Phenylnaphthalene.
  Phenylnitrosamine.
  Phenylpropionic acid.
  Phenyl*iso*propylmethane.
  1 : 3-Phenylpyrazolone.
  Phenylpyridine.
  Phenylquinoline.
  Phenyltartronic acid.
  Phenyltetrahydroquinazoline.
  Phenyl-*p*-toluic acid.
  Phenyltolyl.
  Phenylurethane.
  Phthalic acid.
  Picryldehydropiperidide.
  Piperonylacetone.
  Piperonylmethane.
  Piperonylpropylene.
  Propane.
  Propylmesitylene.

Nitro-derivatives. See :—
  Quinoline.
  Resorcinol.
  Resorcinol diethyl ether.
  Tetramethyldiaminotriphenylmethane.
  Thiophen.
  Thymol.
  Thymotic acid.
  Toluene.
  Tolylmethylnitramine.
  Tolylmethylnitrosamine.
  Trihydroxybutane, tertiary.
  Trimethylindolinone.
  Trimethylindolium hydroxide.
  Tricumaldehyde.
  Uramidobenzoic acid.
  Urethane.
  Urethaneacetic acid.
  Veratrole.
  Xylan.
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- Carbamide.
- Dibenzylbenzidine.
- Dimethylaniline.
- Dimethylnaphthalenes.
- Diphenylamine.
- Diphenylsemicarbazide.
- Di*iso*propylmethane.

Nitroso-derivatives. See :—
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  Heptane.
  Hydroxynaphthoic acid.
  Methylamine.
  Methyl*iso*butylamine.
  Methylpropylamine.
  Naphthylphenylcarbazoles.
  Nortropinone.
  Octane.
  Pentane.
  Phenylaminoacetylazoimide.
  Phenylenethylenediamine.
  3′-Phenylindazole.
  Pipecolinic acid.
  Propane.
  Pulegone.
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 Benzoylmethylresorcinol.
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 Carvacrol.
 Catechol.
 Creosol and *iso*-Creosol.
 o-, *m*-, and *p*-Cresols.
 p-Cymoquinol.
 Diamyloxyquinol.

Phenols. See:—
  Dianthranol.
  Diazophenol hydrosulphide.
  Dibenzyloxyquinol.
  Dihydroresorcinol.
  Dihydroxyacetophenone.
  1 : 2-Dihydroxyphenyl-*p*-phenylsulphone.
  1 : 4-Dihydroxyphenylsulphone.
  o-Dimethoxybenzene.
  Dimethylapionol.
  Dimethylnaphthol.
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  Diphenylhydroxyacetophenone.
  Diphenylsulphone-*o*-aminophenol.
  Duroquinol.
  p-Ethylcresol.
  Eugenol and *iso*-Eugenol.
  Euxanthone.
  Guaiacol.
  Hexahydroxybenzene.
  Homopyrocatechol.
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  Hydroxyhexahydrotoluene.
  Indophenol.
  Menthol.
  o-Methoxy-1 : 3 : 4-xylenol.
  3 : 5-Methyl*iso*butylphenol.
  -Methyl*cyclo*hexanol.
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  3 : 5-Methyl-5-hexylphenol.
  α-Naphthol and β-naphthol.
  Orcinol.
  Phenol.
  Phenyldihydrocarbostyril.
  Phloroglucinol.
  Pinol?
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  iso-Propylquinol.
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  Pyrocatechol (catechol).
  Pyrogallol
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  Arabinose.
  Arabitol.
  Cane-sugar (sucrose).
  Dextrose.
  Diglucose.
  Dulcitol.
  iso-Dulcitol.
  Fructose (levulose).
  Galactan.
  Galactose.
  α-Galaheptose and β-galaheptose.
  Galaoctose.
  Glucoheptitol.
  Glucose.
  Glycerose.
  Lactose.
Sugars. See :—
  Levulose.
  Lyxose.
  Maltose and *iso*maltose.
  Mannan.
  Mannitol.
  Mannose and *d*-mannose.
  Metamaltose.
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  Benzenesulphoneasparagine.
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  ψ-Cumenesulphoneglycocine.
  1 : 2-Dihydroxyphenyl-*p*-phenylsulphone.
  1 : 4-Dihydroxyphenylsulphone.
  β-Dinaphthylpropylenedisulphone.
  Diphenyldisulphonedimethyl-*p*-phenylenediamine.
  2 : 5-Diphenyldisulphone-*p*-phenylenediamine.
  Diphenylenedisulphone.
  Diphenylene sulphide sulphone.
  Diphenylsulphone-*o*-aminophenol.
  Diphenylsulphonediethylethylenediamine.
  Diphenylsulphone-ethylenediamine.
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  Diphenylsulphone-*o*-phenylenediamine.
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  Diphenylsulphonetrimethylenephenylenediamine.
  Methanesulphonepropionic acid.
  p-Methylsulphonefluorescein.
  β-Naphthylallylsulphone.
  β-Naphthylbromopropylsulphone.
  β-Naphthylhydroxypropylsulphone.
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  β-Naphthyliodopropylsulphone.
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  Phenazyldiphenyldisulphone.
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  Sulphonefluorescein.
  Tetraphenyldisulphone-*o*-phenylenediamine.
  o- and *p*-Toluenesulphoneglycocines.
  p-Tolylhydroxymethylsulphone.
  1 : 2 : 3-Trihydroxyphenylsulphone.
  Trimethylene-β-dinaphthylsulphone.
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Appendix.

Agricultural Chemistry.

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  estimation of available potash and phosphoric acid in (**Wood**), T., 287; P., **1896**, 13.

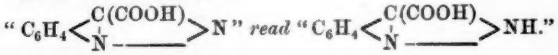
ERRATA.

Vol. LXII (Abstr., 1892).

Page	Line	
420	18	*for* "Brandite" *read* "Brandtite."
585	4	,, "cyanide" *read* "oxide."

Vol. LXIV (Abstr., 1893).

Part I.

124	top	,, "**Acid**" *read* "**Action**."
280	2	,,  "$C_6H_4<\begin{smallmatrix}C(COOH)\\ \mid \\ N\text{———}\end{smallmatrix}>N$" *read* "$C_6H_4<\begin{smallmatrix}C(COOH)\\ \mid \\ N\text{———}\end{smallmatrix}>NH$."
610	8	,, "1892" *read* "1891."

Vol. LXIV (Abstr., 1893).

Part II.

285	2*	,, "C" *read* "Cu."
382	2	,, "**Sundite**" *read* "**Sundtite**."
,,	11	,, "$(Ag_2Cu_2Fe)S,Sb_2S_3$" *read* "$(Ag_2Cu_2Fe)S,Sb_2S_5$."

Vol. LXVI (Abstr., 1894).

Index.

519	4, col. ii,	*for* "animal" *read* "vegetable."

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* From bottom.

VOL. LXVIII (ABSTR., 1895).

PART II.

Page	Line		
172	17	*for*	"K. KOSMAN" *read* "HANS **BERNHARD KOSMANN**."
222	10*	„	"silver iodide" *read* "silver sulphide."
505	2	„	"tetartohedral" *read* "tetrahedral."

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573	15, col. i, *for* "499" *read* "449."

VOL. LXX (ABSTR., 1896).

PART I.

16	25	*for*	"211·5—212·5°" *read* "189·5—190°."
„	28	„	"189·5—190°" „ "211·5—212·5°."
26	10, 11	„	"orthotolueneorthocresetoïl" *read* "orthotolueneazoorthocresetoïl."
27	9,* 8*	„	"*metaphenetoïlparaphenetoïl*" „ "*metaphenetoïlazoparaphenetoïl*."
43	4,* 3*	„	"2 : 3-*diethoxybenzoylformic*" „ "2 : 4-*diethoxybenzoylformic*."
52	12, 13	„	"2 : 7 : 2′ : 7′-*tetramethylxanthylene*" *read* "2 : 7 : 2′ : 7′-*tetramethyldixanthylene*."
89	6	„	"$NO_2\cdot CH(COOH)_2$" *read* "$NO_2\cdot CH(CONH_2)_2$."
147	10*	„	"574" *read* "653."
„	4*	„	"$C_6H_3(NO_3)_3$" *read* "$C_6H_3(NO_2)_3$."
235	16*	„	"*methylphenylhydrazinesulphonate*" *read* "*phenylmethylhydrazinesulphamate*."
343	18*	„	"thiosulphochloride" *read* "thiochloride."
401	5*	„	"$CMe_2{:}CBr\cdot CHMeBr$" „ "$CMe_2Br\cdot CHMeBr$."
425	11*	„	"one ethylic union" *read* "one ethylenic union."
434	13* & 10*	„	"Trimethylphenylacetic acid" *read* "Trimethylphenylglycollic acid."
436	6	„	"Benzylidenemethylhydrazine" „ "Phenylbenzylidenemethylhydrazine."
478	16*	„	"$NPH{:}CH\cdot NH\cdot C_6H_3Cl_2$" *read* "$NPh{:}CH\cdot NH\cdot C_6H_3Cl_2$."
531	14*	„	"2 : 4 : 2-bromiodonitrotoluene" *read* "2 : 4 : 6-bromiodonitrotoluene."
547	23	„	"Hemellitene" *read* "Hemimellithene."
548	5	„	"$NH_2 : NH\cdot NHCONH_2 : COOH$" *read* "$NH_2 : NH\cdot CONH_2 : COOH$."
673	14*	„	"$CHMe_2\cdot CH_2\cdot CH_2\cdot CH(NO_2)\cdot [CH_2]_3\cdot CHMe_2$" *read* "$CHMe_2\cdot CH_2\cdot CH(NO_2)\cdot [CH_2]_3\cdot CHMe_2$."
686	17	*delete*	"$C_{18}H_{16}N_2S_2O_4$."

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* From bottom.

Page	Line	
693	15-29	The constitution assigned to the two naphthylenediaminedisulphonic acids should be reversed, the authors having described the 1 : 3′ . . . 3 : 1′-acid as 1 : 3′ . . . 4 : 1′, and *vice versa.*

Vol. LXX (Abstr., 1896).

Part II.

36	20*	*for* "Ca" *read* "CaO."
37	2	„ "T. E. Wolff" *read* "John E. Wolff."
110	bottom	„ "Mauzelins" *read* "Mauzelius."
197	23	„ "Sebeblien" „ "Sebelien."
371	22	„ "Přzibram" „ "Przibram."
374	17	*after* "**Hornblende**" *insert* "**Hastingsite.**"
480	7	*for* "Frederico Shickendantz" *read* "Federico Schickendantz."
586	10*	„ "Dumorierite" *read* "Dumortierite."
596	10*	„ "John Norman Lockyer," *read* "Joseph Norman Lockyer."
597	3 & 20	„
655	25	„ "**Water**" *read* "**Waters.**"
„	26	„ "1895" *read* "1896."
„	18*	„ "mineral" *read* "rock."
659	6	„ "; by" *read* "and."

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Page	col.	
699	1	*insert* **Dixon,** *Augustus Edward,* thiocarbimides derived from complex fatty acids, T., 1593 ; P., **1896**, 223.
708	2	„ **Hada,** *Seihachi,* how mercurous and mercuric salts change into each other, T., 1667 ; P., **1896**, 182.
724	2	*for* "**Luxmore**" *read* "**Luxmoore.**"
898	2	15* 14* *for* "*d-iso*-Propylpropane dd_1d_1-tricarboxylic" *read* α-*iso*-Propylpropane $\alpha\alpha_1\alpha_1$-tricarboxylic."
929	2	top line *delete* "salts," *after* "Magnesium."
990	1	3 *after* "Propionic acid" *insert* "β-iodo-."

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* From bottom.

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